

Rational ImagingTM

INSTALLATION

Version 6.1.0

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Table of Contents

I.	OVERVIEW.....	1
A.	SUMMARY.....	1
B.	GETTING HELP.....	1
C.	QUICK START.....	1
II.	SYSTEM REQUIREMENTS.....	2
A.	HARDWARE CONFIGURATION.....	2
B.	SOFTWARE ENVIRONMENT.....	3
C.	SUPPORTED IMAGING SCANNERS	4
III.	PLANNING YOUR PACS SYSTEM.....	6
A.	PREPARE SYSTEM WORKSHEET	6
B.	DEFINITION OF WORKSHEET COMPONENTS	8
IV.	DATABASE SERVER.....	12
A.	SUMMARY.....	12
B.	GENERAL INFORMATION.....	12
C.	SOLARIS INSTALLATION	13
D.	RATIONAL IMAGING INSTALLATION	14
V.	SATELLITE WORKSTATION.....	17
A.	SUMMARY.....	17
B.	SOLARIS INSTALLATION	18
C.	RATIONAL IMAGING INSTALLATION	18
D.	CONFIGURATION.....	19
VI.	MULTI-DATABASE CONNECTIVITY.....	22
A.	CREATING A NEW DATABASE.....	22
B.	CREATING MULTIPLE SERVERS.....	23
C.	COPY EXAMS BETWEEN DATABASES	25
VII.	UPGRADING A WORKSTATION	26
A.	SUMMARY.....	26
B.	SCHEDULE UPGRADE TIME.....	26
C.	BACKUP DATABASE FILES	26
D.	BACKUP APPLICATIONS.....	26
E.	BACKUP SYSTEM FILES.....	27
F.	BACKUP USER TEMPLATES AND DEFAULTS.....	27
G.	INSTALL NEW VERSION	27
H.	DATABASE UPGRADES	28
I.	CONFIGURATION.....	29
J.	TESTING.....	29
VIII.	TAPE BACKUP DEVICE.....	30
A.	SOLARIS INSTALLATION	30
B.	TESTING.....	30
C.	CONFIGURATION.....	31
IX.	JUKEBOX INSTALLATION	33
A.	HARDWARE CONFIGURATION.....	33
B.	AIT DRIVE PREPARATION.....	34

C.	DIFFERENTIAL LOW VOLTAGE SCSI CARD (INSTALL NOTES).....	35
D.	SOLARIS INSTALLATION	36
E.	TESTING.....	36
F.	CONFIGURATION.....	37
G.	REMOVING EXISTING APUNIX DRIVERS	38
X.	VIDAR FILM SCANNER INSTALLATION.....	39
A.	SUNOS INSTALLATION.....	39
B.	SOLARIS INSTALLATION	39
C.	TESTING.....	40
D.	CONFIGURATION.....	40
XI.	MODEM INSTALLATION.....	41
A.	MODEM SETUP	41
B.	SOLARIS INSTALLATION	42
C.	TESTING.....	42
D.	CONFIGURATION.....	42
XII.	RAPTOR VIDEO CARD INSTALLATION	43
A.	SUMMARY.....	43
B.	INSTALLATION.....	43
XIII.	DISPLAY CALIBRATION.....	44
A.	INSTALLATION.....	44
B.	CALIBRATION PROCEDURE	45
C.	SMPTE PATTERN.....	46
D.	DOM MONITOR CALIBRATION.....	46
E.	ALL MONITOR CALIBRATION.....	47
F.	PRINTER CALIBRATION.....	47
XIV.	CANON DIGITIZER.....	48
A.	SCANNER CONFIGURATION.....	48
B.	SOLARIS INSTALLATION	49
C.	RISCANC SETUP	50
D.	CANON CFS300 CALIBRATION	51
XV.	DISK INSTALLATION.....	54
A.	UNIX PREPARATION	54
B.	ADDING TO THE RATIONAL IMAGING SYSTEM	55
C.	TESTING.....	55
XVI.	ASPECT DICOM INTERPRETER INSTALLATION	56
A.	UPGRADING.....	56
B.	KODAK CONFIG PARAMETERS	56
C.	CONFIGURATION STEPS	57
XVII.	RIS CONNECTIVITY INSTALLATION.....	58
A.	LICENSING	58
B.	RILINK CONFIGURATION	58
C.	RIDELIVERD CONFIGURATION.....	59
D.	MESSAGE TESTING.....	61
E.	RILINK TROUBLESHOOTING.....	62
F.	RIDELIVERD TROUBLESHOOTING	63
G.	RIDISTRIBUTE PREFETCH CONFIGURATION	63
H.	STUDY CONTENT NOTIFICATION	64
I.	RIDELIVER – MANUAL RECONCILIATION.....	65

J.	DELETING OLD MESSAGES (WORKLIST, PREFETCH, AND SCNEXAM)	66
XVIII.	RIQUERYD INSTALLATION	67
A.	FUNCTIONALITY	67
B.	CONFIGURATION.....	67
C.	INSTALLATION.....	68
D.	MULTIPLE DATABASES	68
E.	EFILM – INSTALL TEST CLIENT.....	69
F.	EFILM – CONFIGURE DICOM STORAGE SCP	69
G.	EFILM – CONFIGURE QUERY RETRIEVE	69
XIX.	RIPRINTQ INSTALLATION.....	71
A.	LICENSING	71
B.	REQUIRED FILES.....	71
C.	RIPRINTQ CONFIGURATION.....	71
D.	RIPRINTQ PRINTER ADDITION.....	73
E.	RUN AS BACKGROUND PROCESS.....	73
F.	TESTING.....	73
G.	RESET QUEUE.....	74
H.	DELETE PRINTPAGES IN THE QUEUE	74
XX.	BLAST INSTALLATION	76
A.	BLAST SETUP	76
B.	INSTALLING HYPERTERM ON THE PC	77
C.	TESTING.....	77
XXI.	LASERCAMERA (FILM) INSTALLATION.....	79
A.	SUNOS INSTALLATION.....	79
B.	SOLARIS INSTALLATION	79
C.	CONFIGURATION.....	80
D.	KODAK CONFIGURATION.....	81
E.	TESTING.....	81
XXII.	OPERATORS MANUAL INSTALLATION.....	83
A.	SUNOS INSTALLATION.....	83
B.	SOLARIS INSTALLATION	83
C.	CONFIGURATION.....	83
XXIII.	NETWORK ARCHITECTURE	84
A.	CLIENT SERVER RELATIONSHIPS	84
B.	CENTRALIZED DATABASE	84
C.	DISTRIBUTED IMAGE DIRECTORIES	84
D.	NETWORK DEPENDENCY AND RELIABILITY.....	85
XXIV.	ADMINISTRATIVE TASKS	87
A.	SYSTEM DIAGNOSTICS.....	87
B.	ACCESSING/CHANGING DATABASE CONFIGURATION INFORMATION	89
C.	PERFORM SYSTEM BACKUP.....	93
XXV.	CHANGE SERVER HOST.....	95
A.	SUMMARY.....	95
B.	PROCEDURE	95
XXVI.	SYSTEM MAINTENANCE	98
A.	SHUTDOWN DATABASE SERVER.....	98
B.	SHUTDOWN ADD-ON WORKSTATION	99

XXVII.	DATABASE ERRORS.....	101
A.	OVERVIEW	101
B.	PREVENTING USE OF THE DATABASE DURING ANALYSIS AND MAINTENANCE.....	101
C.	DETERMINING THE DATABASE ERRORS.....	101
D.	REMOVING DUPLICATE KEYS	102
E.	MISSING DATA POINTERS.....	103
F.	EXPORTING THE DATA IN A DATABASE.....	103
G.	IMPORTING THE DATA AND CREATING A NEW DATABASE	103
H.	OPTIMIZING DATABASE QUERIES.....	104
I.	EXAMPLE PROCEDURE FOR MISSING DATABASE LINKS.....	104
J.	DETERMINING THE DATABASE VERSION.....	107
XXVIII.	REBUILD SERVER - EMERGENCY	108
A.	OVERVIEW	108
B.	SYSTEM PREPARATION.....	108
C.	REBUILD - RETRIEVE DATABASE FROM ARCHIVE TAPE	109
D.	REDUNDANT SERVER.....	110
XXIX.	INSTALLATION WORKSHEET.....	112
A.	SUMMARY.....	112
B.	WORKSTATION IS THE MAIN DATABASE SERVER.....	113
C.	WORKSTATION IS THE REDUNDANT DATABASE SERVER	115
D.	WORKSTATION IS MULTIPLE DATABASE SERVER IN A NETWORK	117
E.	WORKSTATION IS THE SATELLITE WORKSTATION	119
F.	WORKSTATION IS A STAFF WORKSTATION (RIDISPLAY)	121
G.	EXTRA IMAGE PARTITION/DISK (OTHER THAN /IMG)	123
H.	EXTRA SUN COLOR MONITOR(S)	124
I.	INSTALL DOME VIDEO ADAPTER WITH DATARAY MONITOR	125
J.	CANON POSTSCRIPT PRINTER(S).....	127
K.	SEEMOR REFERRING WORKSTATION PRINTER(S)	128
L.	REMOTE LOW-BANDWIDTH WORKSTATION PRINTER(S)	129
M.	FILM (LASERLINK) PRINTER.....	130
N.	VIRTUALRAD PRINTER	131
O.	DICOM PRINTER.....	132
P.	GE CT & MR SCANNERS (5X AND ABOVE USING ADVANTAGENET)	133
Q.	GE MR SCANNERS (SIGNA 4X)	134
R.	DICOM SCANNERS.....	135
S.	NUCLEAR MEDICINE SCANNERS (INTERFILE FORMAT)	136
T.	LUNAR MR SCANNERS	137
U.	GATEWAY WORKSTATION (LOW BANDWIDTH).....	138
V.	TAPE DRIVE (STANDALONE PRIMARY ARCHIVE)	139
W.	JUKEBOX (SECONDARY ARCHIVE).....	140
X.	VIDAR FILM DIGITIZER.....	141
Y.	CANON CFS300 FILM DIGITIZER.....	142
Z.	MODEM ON WORKSTATION	143
AA.	BLAST REQUIRED TO SEND IMAGES TO PC's/MAC's.	144
BB.	RIS CONNECTIVITY	145
CC.	USER SETUP	146
DD.	MOVE DATABASE TO NEW SERVER.....	147
EE.	CHANGE HOSTNAME OF RATIONAL IMAGING WORKSTATION	149
FF.	RATIONAL IMAGING UPGRADE (VERSION 4.1 OR LATER).....	150
GG.	RATIONAL IMAGING UPGRADE (PRIOR TO VERSION 4.1).....	151
HH.	UPGRADE INFORMIX SOFTWARE	152
XXX.	INDEX.....	153

I. Overview

A. SUMMARY

This manual will discuss the current system requirements, installation procedures and administrative functions for the **Rational Imaging** system. Since the software comes pre-installed on the RI workstations, you should not need to consult the installation portion of the administrator's manual. However, it may be useful to review these sections to understand the complexity of the system and appreciate the careful planning involved in integrating the software and hardware components of the system.

DO NOT reinstall the database system. Doing so will compromise the integrity of the patient archives (backup tapes) and will VOID the warranty.

If you need to add a user, tape drive, archive tape set, or limit a user's access to a particular facilities images, then read the sections of this manual which describe such functions. The table of contents combined with the index should help you locate the desired information quickly.

B. GETTING HELP

Due to the complexity of networked imaging systems, consult our technical support staff when initially changing or adding new system information. Information regarding the phone and fax numbers of your regional technical support office was included in this package on the card marked "**Technical Support**". Keep this card near each workstation for convenient access.

If you wish to report a problem, please include your name, position, the name of your facility, your fax and phone numbers, and a description of the problem. Please be as specific as possible in defining the symptoms of the problem. A system log book has been provided to help you document any problems.

C. QUICK START

Read chapters I through III for the basics of the Rational Imaging configuration and architecture. Then follow the table of contents or index to locate the specific installation instructions for the workstation configuration (server/Main or client/Satellite) or other peripheral devices. Consider the networking chapter and the redundant server section of the emergency chapter when designing your imaging network.

II. System Requirements

A. HARDWARE CONFIGURATION

1. Workstation

SUN SparcStation 2 or higher. Due to the extensive computation involved in image processing, a SparcStation 10 or above is recommended for efficient diagnostic interpretation where processing time is critical.

High resolution, fast refresh monitor. Use of a smaller or lower quality monitors will degrade the image quality and could limit diagnostic perception. SUN has a line of large screen monitors sufficient for MR, CT or Ultrasound diagnosis. Higher resolution 2K greyscale monitors are also available and may be required for mammography or ultra fine detail imaging.

1GByte hard disk. Images require a great deal of disk storage space. The initial disk space may become limited as additional workstations or scanners are added to the system. The database design allows additional disks to be added with very little effort. Additional workstations can also be added and their disk space will become part of the available image disk space.

64MBytes of RAM. Although this is sufficient for most single processing tasks, 64MBytes may limit the number of concurrent multi-processing tasks such as multi-exam displays, background import/export functions, or display of exams requiring a great deal of memory such as Cardiac MRI. Therefore **128MBytes of RAM** is recommended.

2. Network

Copper or Fiber optic network supporting TCP/IP protocols. Routers may be used to restrict local network traffic or control Wide-Area networks. Consult your system administrator to optimize the network when image traffic reduces system performance and becomes prohibitive.

Network hardware for the scanners you wish to include in the network. Talk with the scanner manufacturer or our technical support staff to determine which scanners are network compatible with the ***Rational Imaging*** system. The scanners supported by Rational Imaging as of this manual's printing are specified at the end of this chapter. If your scanner does not appear on this list, then contact our technical staff since this list will be updated as software interfaces are developed for these systems.

Since the performance of the system will be integrally dependent upon the network, develop it conscientiously with careful attention to any future expansion. Use duplicity wherever necessary to ensure network reliability since each workstation is dependent upon each other and especially dependent upon the database server to obtain patient demographic information.

3. Printer

Canon's Paper Film Imager has been manufactured with the highest quality components to produce high resolution diagnostic hardcopy. Even so, the printer is susceptible to adverse environmental conditions and may require maintenance from time to time. It is recommended procedure to **print the SMPTE quality control pattern once each day**, dating the reverse side of the print, to document any degradation or systematic artifacts. Slight imperfections will be more visible on the uniform background squares of the SMPTE image than on noisy images containing randomly dispersed quantum mottle.

Pay close attention to Canon's recommendations for the **use and storage procedures of the paper** used for diagnostic hardcopy. Preliminary research has demonstrated that poor quality paper, or over exposure to humidity, may produce visible artifacts and non-uniformity.

4. Tape Drive

HP DDS2 or Sony DDS3 DAT archive tape drive. Dual tape drives are highly recommended to minimize the likelihood of data loss due to dirty heads or tape malfunction. Follow the protocols developed for dual tape set archival specified in the User's Manual.

The DDS2 capacity is 4GB Native on 120m tapes. The DDS3 capacity is 12GB native on 125m tapes. Both drives achieve approx 1.5 compression on medical images.

Use only high quality **verified data cartridges** for your primary archives which have been recommended by the tape drive manufacturer. Since these archive tapes are a minimal expense (approx 5 cents per patient), it is not worth it to take chances with low quality tapes.

B. SOFTWARE ENVIRONMENT

1. UNIX Operating System

SunOS 4.1.3 or 4.1.4 UNIX operating system (Solaris 1.x). Solaris 2 versions now available (Solaris 2.5 recommended).

2. Open Windows Graphical Interface

Open Windows Version 3.0 - 3.1. The graphical workspace provided by SUN has been optimized during installation to provide the highest quality diagnostic environment. It can be changed to suit a particular user's preference using the functions described in Sun's Deskset applications manual.

3. Informix Database Software

This commercial database has been incorporated to provide optimal network efficiency, standard query language (SQL), and maximal information integrity. Consult the user's manual for information regarding the database structure and use extreme caution when interfacing your own applications with this database. Any unauthorized modification of these database tables without the specific written consent of IST and Canon will void the warranty and may corrupt the integrity of the system.

4. Rational Imaging System

The Rational Imaging system has been pre-installed on your workstation and may be reinstalled from the disks provided by Canon. **Warning:** these applications have been keyed to your workstation's unique host ID and will not work on other workstations. If the motherboard of the system is replaced, or if system maintenance is required, then contact your sales representative for a new authorization code.

5. Tape Device Driver

The tape device drivers (/dev/nrcdt0, /dev/nrcht0, or /dev/nrht0) have been developed to utilize the high speed components of the Hewlett Packard DAT tape drive. The normal SCSI device driver may be used with this drive (/dev/nrst0), however you will notice considerable performance degradation especially when trying to retrieve exams near the end of the tape. When the "/dev/nrcht0" device driver is used, the DAT drive will use a hardware lossless compression algorithm built into the DAT drive to compress the image information. This compression will increase the tape capacity by approximately a factor of 2, however the compressed tapes will be unreadable on standard DAT tape drives without compression. If compatability with other existing DAT drives is important, then use the "/dev/nrht0" device driver. Make sure to specify the **non-rewindable tape device driver** specified by the 'n' in "/dev/nrht0".

The new Sony DDS3 drive uses a device called "/dev/nrcdt0".

C. SUPPORTED IMAGING SCANNERS

1. Import Images

The following images are currently supported for **import**:

- General Electric's Signa 4x MR scanner. A Data General ethernet adapter kit is required and is available through General Electric.
- General Electric's Genesis 5x MR scanner. The MR scanner comes with an ethernet card sufficient for image transfer.
- General Electric's Genesis 5x CT scanner. An additional SUN ethernet adapter kit is required and is available through General Electric. Warning: use of the gantry's network adapter may effect scanning.
- General Electric's Genesis 5x Independent Console. The IC workstation comes with an ethernet card sufficient for image transfer.
- Siemens MR Magnetom Impact with a SUN host. Image connectivity has been established, however some of the header information is still missing making cross-referencing impossible as of now.
- Lunar MR Scanner.
- Additional scanners using DICOM protocols will also be able to connect. Check with your sales representative for a current list of tested scanners.

Note: check with our technical support staff before accepting scanner upgrades to make sure that the upgrades do not effect the ethernet interfaces.

2. Export Images

The following images are currently supported for **export**:

- General Electric's Signa 4x MR scanner
- General Electric's Signa 5x MR scanner

- General Electric's Signa 5x CT scanner

Note: availability of export functions will be limited by DICOM compatability and each manufacturer's endorsement of this transfer capability. Current liability issues may prohibit dual transfer capabilities.

3. Drag-and-drop Import

RI'port supports the standard Open Windows convention of drag-and-drop. If an image file has a known header, then the file can be dragged over the sensitive rectangle on the RI'port console and imported into the system. Groups of images can also be imported in this fashion. See chapter 5 in the user's manual for more information on the operations of this function.

The following images are currently supported for drag-and-drop import

- General Electric's Genesis 5x MR, CT, and IC images.
- General Electric's Signa 4x MR images.

4. Incoming Directory

A directory called the "incoming" directory has been created to import images from foreign databases (usually set up as /img/incoming). By simply copying images into this directory and renaming them based on their origin or image format, the database will recognize these images and update the database. The unix program which operates in the background (daemon) and which performs this function is "riupdate". Make sure to rename the images after copying so that the image transfer is complete before the images will be recognized by riupdate. Use the following naming conventions for each image type:

<u>Format</u>	<u>Examples</u>	<u>Image Type</u>
GEgen.host.#	GEgen.mr1.1	GE Genesis 5x format
GESig.#	GESig.1, GESig.2	GE Signa 4x format
RIint.#	RIint.1, RIint.2	Interfile format
RIdicom.#	RIdicom.1, RIdicom.2	DICOM format
Smmag.host.exm-ser-img.ima	Smmag.ct1.9995-3-24.ima	Siemens MR image
RIlunar.#	RIlunar.1	Lunar MR image

The images can also be put in a temporary directory under /img/incoming, and then just rename the directory with the previous conventions. Do not rename the directory until all the images within are completely transferred. This will signal "riupdate" to load the images into the database.

III. Planning Your PACS System

A. PREPARE SYSTEM WORKSHEET

Installation of the *Rational Imaging* system is very complex in that it must be configured correctly to interact with the other existing workstations. If this is the first *RI* workstation in your facility (the database server), then it must be configured to interact with the scanners over the newly installed network. Additionally, system security and accountability require the creation of user accounts which will prevent unauthorized access to both the workstation and the *Rational Imaging* system. This will take some planning and our staff has been trained to guide you in this preliminary effort. Once the system has been installed, it will require minimal effort unless new users are required or an additional workstation or scanner is added.

The information described in this chapter will be configured during the installation. Consult with our technical staff, the service engineers of the various imaging equipment, and your own systems administrator to coordinate the network addressing and user configuration.

The following worksheet has been prepared to demonstrate a typical configuration and help you understand the various components involved. Actual worksheets will be made available during the installation for you to fill in the desired information.

EXAMPLE INSTALLATION WORKSHEET

SUN OR SCANNER HOST INFORMATION

HOSTNAME	ALIAS	INTERNET	TYPE
<i>sunrise</i>	<i>Sunrise</i>	<i>194.3.55.15</i>	<i>SUN</i>
<i>cardiol</i>	<i>Cardiology</i>	<i>194.3.55.18</i>	<i>SUN</i>
<i>mr1_sj</i>	<i>MR1@SJ</i>	<i>194.3.55.19</i>	<i>GE Genesis 5x MR</i>
<i>ct1_sj</i>	<i>CT1@SJ</i>	<i>194.3.55.20</i>	<i>GE Genesis 5x CT</i>

SUN IMAGE DIRECTORIES

PHYSICAL DIR	HOST LINKED DIR	ALIAS	HOST
<i>/img</i>	<i>/net/sunrise/img</i>	<i>Sunrise #1</i>	<i>sunrise</i>
<i>/img</i>	<i>/net/cardiol/img</i>	<i>Cardiol #1</i>	<i>cardiol</i>
<i>/img2 (disk 2)</i>	<i>/net/cardiol/img2</i>	<i>Cardiol #2</i>	<i>cardiol</i>

UNIX ACCESS GROUPS

GROUP NAME	UNIQUE GROUP ID
<i>imaging</i>	<i>100</i>
<i>informix</i>	<i>101</i>

NETWORK PRINTERS

HOSTNAME	ALIAS	INTERNET	QUEUE DIR	ERROR LOG
<i>canon</i>	<i>Canon PFI</i>	<i>194.3.55.16</i>	<i>/home/ist/print</i>	<i>/home/ist/print/queue/canon_errs</i>
<i>canon_ct</i>	<i>Canon@CT</i>	<i>194.3.55.21</i>	<i>/home/ist/print 2</i>	<i>/home/ist/print2/queue/canon_errs</i>

TAPE DRIVES

HOSTNAME	DEVICE	NAME	BLOCKS	CLEAN TIME	MBYTES
<i>sunrise</i>	<i>/dev/nrcht0</i>	<i>DAT1@Sunrise</i>	<i>20</i>	<i>90000</i>	<i>6000</i>
<i>cardiol</i>	<i>/dev/nrcht0</i>	<i>DAT1@Cardiol</i>	<i>20</i>	<i>90000</i>	<i>6000</i>

ARCHIVE TAPE SET

ARCHIVE NAME	Type
<i>Primary</i>	<i>Primary</i>
<i>Secondary</i>	<i>Secondary</i>
<i>LiverStudy</i>	<i>Normal</i>
<i>JonesExams</i>	<i>Normal</i>

PATIENT DATABASES

DATABASE NAME	DIRECTORY	RESTRICTED	RESTRICTED USER
<i>radiology</i>	<i>//DBHost/db</i>	<i>0</i>	
<i>cardiol</i>	<i>//CardiolHost/db</i>	<i>1</i>	<i>jones</i>

USERS

USERNAME	<i>imaging</i>	<i>smith</i>	<i>jones</i>
ALIAS	<i>Imaging</i>	<i>Dr. Smith</i>	<i>A.K.Jones, M.D.</i>
UNIQUE ID	<i>102</i>	<i>103</i>	<i>104</i>
GROUP ID	<i>100 (imaging)</i>	<i>100</i>	<i>100</i>
HOME DIR	<i>/net/sunrise/home/imaging</i>	<i>/net/sunrise/home/imaging</i>	<i>/net/cardiol/home/jone</i>
TEMPLATE DIR	<i>/net/sunrise/img/templates</i>	<i>/net/sunrise/img/templates</i>	<i>/net/cardiol/img/tmpl</i>
DEFAULT DIR	<i>/net/sunrise/img/defaults</i>	<i>/net/sunrise/img/defaults</i>	<i>/net/cardiol/img/dflt</i>
PRINT DIR	<i>/home/ist/print</i>	<i>/home/ist/print</i>	<i>/home/ist/print</i>
PASSWORD	<i>images</i>	<i>on!call</i>	<i>transplant!</i>
DATABASE ACCESS	<i>radiology</i>	<i>radiology</i>	<i>radiology, cardiol</i>

B. DEFINITION OF WORKSHEET COMPONENTS

1. Host Information

A network consists of multiple workstations communicating together over an ethernet backbone. In order for these workstations to co-exist on the same network, they must follow rules for existence. The following parameters are required for network compatibility.

Hostname: The first is that each workstation must have a unique hostname. This name will be used to send and retrieve information from the workstations. We recommend that you use lowercase characters for the hostname since UNIX is case sensitive. Also limit the hostname to as few characters as possible since long names consume space for each of the hosts and the NFS linked image directories.

Alias: The name which will be displayed and used within the Rational Imaging system. Uppercase letters may be used to distinguish components of the name. Try to restrict the length of the alias as much as possible. For example, a workstation at Stan University in the department of radiology might be given a hostname of "stan_rad" and an alias of "StanRadiol".

Internet address: You must assign a unique internet address for workstations to exist simultaneously on a local area network. If you are planning to install a wide area network and interact with other global networks, then it is recommended to obtain registered internet addresses so that you will not conflict with other networks as they are attached.

Type: The following types of workstations will use the Rational Imaging system and must be configured in the system tables of the database:

- SUN RI Workstation
- GE Genesis MR
- GE Genesis CT
- GE 4x MR
- GE Genesis Independent Console
- DICOM Version 3
- Interfile format
- Siemens Magnetom MR

This information is added to the "host" table and must also be configured in the "/etc/hosts" file of each workstation.

2. Image Directories

The Rational Imaging system uses a distributed architecture for storing images. This allows you to add additional disk drives to any of the RI workstations, and then add the new configuration parameters into the system table "image_dir". NFS links are used to transparently access the images no matter where they are located.

The following information is therefore required to configure these directories:

Physical directory: The physical location on a selected workstation which you have created to store the images. Do not use the database or UNIX operating system partitions as image directories, or you may crash the database (or UNIX) if you run out of disk space while importing images.

Host Linked Directory: The directory structure defined on each workstation to allow you to NFS link these directories. By convention, the workstation hostname follows /net to allow network automounting (eg: /net/hostname/img_partition/database/exam...). This will allow the images to be accessed from any workstation. In a single database environment, or where separate partitions are used for each databases images, the database element of the path can be ignored.

Alias: The alias for the image directory. This is a brief name by which you will refer to the directory. We recommend a brief acronym for the hostname and maybe a disk number if multiple image directories are attached to a particular system.

Hostname: The hostname of the workstation that is physically linked to the disk.

3. Unix Access Groups

Unix assigns group names and unique group IDs to individual's who share a similar function. For example, since all of the users of the Rational Imaging system have one function in common, imaging, they will be assigned to this group. Therefore, first the group must be created in the "/etc/group" file, and then each user must be configured as a member of this group in the "/etc/passwd" file.

The main purpose of the UNIX group is to give consistent security and file access to a group of users. As a member of the *imaging* group, you will be given read and write permission to access any of the files created within the Rational Imaging system (images, exam demographics, etc...).

Group name: The name of the group defined in the "/etc/group" file.

Group ID: The unique number assigned to this group.

4. Network Printers

The Canon printer is a network device much like the *RI* workstations. It must follow the rules for configuring network workstations as described above.

Hostname: The hostname should be defined as a unique name consisting of as few characters as reasonable possible to describe the workstation.

Alias: The alias will be used to refer to the workstation within the RI system.

Internet address: The internet address is the unique network address for the printer.

Queue Directory: The queue directory is a directory where the UNIX print program will maintain a queue of print pages during printing. This directory must also be specified in the "/etc/printcap" file.

Error Log: The name of the error log file should also exist in the print queue directory. This file will record an errors which occur with the printer (disk space full, printer turned off, network down, etc...).

5. Tape Drives

Tape drives, used for archiving and long term storage of exam information, are physically attached to the *RI* workstations via SCSI connections. It is important for Rational Imaging to know where these devices are attached and various parameters specific to these devices. This information will be added to the "tape_drive" table.

Hostname: The hostname of the workstation that the tape drive is attached to.

Device: The device driver for the tape drive. **WARNING:** Use the non-rewindable device driver as specified by the 'n' in `"/dev/nrcht0"`.

Name: The alias for the tape drive which will be used by the Rational Imaging software.

Blocks: The number of blocks which are written consecutively. UNIX commonly uses **20 blocks**, however higher values may improve performance (Since 20 is the default among UNIX workstations, we recommend this value for compatibility).

Clean Time: The number of minutes of use before the heads require cleaning. Hewlett Packard recommends that the heads be cleaned every 25 hours of use. This is equivalent to 90,000 minutes. The database keeps track of the drive usage, and will warn you automatically when it is time to clean the heads.

MBytes: The approximate storage capacity of a tape in MBytes. Since compression may be used, and the compression factor will vary, this number will only be an estimate. Also the storage capacity will depend upon whether 60 meter or 90 meter tapes are used. A compressed 90 meter tape should be able to conservatively hold 3 GBytes (3000 MBytes). A 120 meter tape will hold 6 Gbytes. A 125 meter tape (DDS3) will hold 12Gbytes. Each of these will hold approx 1.5x the native capacity when compressed. Thus a DDS3 125 meter tape should hold approx 18Gbytes.

6. Tape Archives

The values entered into the table "archive" are used to define sets of tapes with a common base. For example, one tape set (group of tapes) may consist of all the primary patient archives for a facility and be labeled "Initial". Another tape set may be used for duplicity (secondary backup), and be called "Active". You may also create tape sets for individual purposes such as research projects or personal archives.

Tape Set: The name of the archive, as it will be physically labeled on the tape and written in the digital label at the beginning of the tape. This name will be used to refer to the tape set in the RImore program.

7. Patient Databases

The patient databases which control the demographic and image information for a group of images. Rational Imaging is usually configured with one database, giving everyone access to the images within. However, the capability exists to create separate databases and limit the access to these databases to certain individuals. This may be necessary where multiple facilities or departments are involved.

Name: The name of the database as it was created on disk during installation. If the physical directory is "radiology.dbs", then the database name is "radiology".

Directory: The host and directory that the database is located in. This should be entered in the following format `"/hostname/db_dir"`.

Restricted: Whether the database is restricted. If not restricted (=0), then any user created in the "users" table will have access to that database. If it is restricted (=1), then an entry in the "databases" table must exist for each user that is allowed access.

User: If restricted, the user name (or key from the "users" table) who is allowed access. The database entry must be created multiple times on restricted databases for each of the authorized users.

8. Users

The user information is gathered and entered into the `/etc/passwd` file for UNIX access, and into the `"users"` system table for the *Rational Imaging* system. A *Rational Imaging* user must also have UNIX access, however the reverse is not true.

Username: An individual unique username must be assigned to each user within the system. This name is limited to 8 characters. Lowercase letters are recommended.

Alias: The alias used to refer to the user. This name is the formal name which the *Rational Imaging* system will display. For example, **"smithj"** may be the username for the alias **"John H. Smith, M.D."**.

Unique ID: A unique user ID must be assigned to configure the UNIX user account properly. This ID must be assigned in the `/etc/passwd` file on EACH workstation.

Group ID: The group ID must also be assigned and should be given the same number as the *imaging* group.

Home Directory: The home directory for the user's account. Multiple users may share a home directory if given group permission, or each may be given their own home directory. Separate locations require slightly more effort to configure and maintain, however this isolates the damage that an individual may due when changing his/her personal preferences such as background color, menu structure and other UNIX or Open Windows parameters.

Template Directory: The template directory is the location defined to contain the `"load"` and `"print"` templates for the RI system. Usually one location is used by all, however in the case of multiple departments or facilities, multiple template directories may be required to optimize each appropriately.

Default Directory: The default directory is used to store each program's default parameters. Preferences such as window location and startup features may be customized for each of the programs. If everyone shares a common default directory, then a common interface is maintained. For those who wish to customize their own interface, assign a new default directory and copy the files from the current default directory to the new directory.

Print Directory: The print directory is used to store the temporary files created during the print process. Each print page consumes approx 7-24 MBytes of disk space, so use a directory with sufficient space if you are printing multiple print pages for each exam. Do not use directory partitions which will corrupt the database or UNIX operating system if they become full with these temporary files (`"/"`, `"/usr"`, `"/databasedir"`). After successful printing, the images are removed. Do not use a NFS linked directory otherwise additional network traffic will result.

Password: The personal password for the user. This should be changed on a regular basis to maintain system security. Always change a password if other people know your current password.

Database Access: Duplicate information already entered in the image databases table described above.

IV. Database Server

A. SUMMARY

The database server is a mandatory component of the *Rational Imaging* system and will maintain the patient information for the current images within the system, and an archive database for locating exams on the various tape archive sets. The server may also be used as an imaging workstation for facilities with a low case load.

The *Rational Imaging* system will be pre-installed by the manufacturer and will be configured on-site by our professional installation staff. The previous chapter provides guidance for determining your system configuration. Once the system parameters have been defined and approved by Canon, the installation process can begin.

B. GENERAL INFORMATION

Before you begin, make sure that you have the following materials:

1. Sun Workstation to be installed
2. CDROM drive
3. Solaris CD
4. DAT tape drive or Jaz drive
5. SCSI cables
6. Tools
7. Rational Imaging installation tape or jazz disk
8. Rational Imaging installation manual
9. Informix licenses (INET for satellite, INET & SE & ESQL for main and redundant server)
10. Rational Imaging licenses
11. APunix licenses (for DAT or JUKEBOX installations)

You will be prompted for information during the UNIX installation. Use the following guidelines to help you complete this installation.

Hostname: Give the workstation a name which will be unique to the network it is on. This name may be personal or reflect the location of the system. For example, if the workstation is in Dr. Joseph's office, then *joseph* may be an appropriate name. Or if it is the third workstation in the reading room, *diag3* may fit. Or if the workstation is located in the MR department and use to display brain scans then perhaps *mr_brain*. Since all names are case sensitive in UNIX, it is a general convention to keep these names and user names in lower case. It is also best to keep these names short yet specific. **The RI database limits host names to 32 characters, however much shorter names are recommended (8-12 characters).**

Internet Address: Set up the network internet address for the workstation. These values should be registered with internet and coordinated with your facilities systems administrator, especially if wide area connectivity is being considered. These addresses will probably be Class C addresses (above 192 for the first numeric component of the address) if less than 256 workstations will be connected within the local imaging network. Routers can combine networks with different base addresses, so this is not really a serious limitation.

The SUN administrator's manual describes how internet addressing should be assigned. Each device on the network needs a unique address, much like your home. The post office knows where to deliver your mail depending on your street address, city, state, and zip code. The same is true for computers. When your computer sends a command to "mri_scanr1", a system file called *"**etc/hosts**"* will have the correct address for that device. Your computer will then broadcast the address and the command over the network. When the computer with that address (mri_scanr1) sees the command, it will answer the calling party with appropriate TCP/IP network commands. Understand that this is a very brief description of networking, which can become much more complex. Consult with our professional installation staff and your system's administrator regarding this information.

C. SOLARIS INSTALLATION

This part of the installation will be pre-installed or will be accomplished by your *RI* representative in the event of a system or hard disk failure.

Make sure to have all the hardware attached and powered up prior to loading the Solaris operating system. Otherwise Unix may not recognize the tape drives, Jukeboxes, or Vidar scanners attached to the system and the following installations will fail. If this hardware is added after the Solaris operating system has been added, make sure to let Unix reconfigure for it by typing **"boot -r"** at the boot prompt **"OK>"**.

Many of the following instructions will be described in detail in the manuals provided by the various manufacturers of the system components. Since the manufacturers may update these instructions from time to time, we will refer you to those manuals for the most current instructions.

Boot from the Solaris system cdrom. Insert the disk into the CD drive, and enter **"boot cdrom"** from the boot prompt **"OK>"**. Follow the software installation instructions provided by SUN for the UNIX and Open Windows environment. Use the following sections as guidance during this installation.

If you are using an Ultra 5 or 10, the cdrom may not be recognized. Use the following command at the boot prompt to boot the cdrom on these systems:

```
nvalias extcd /pci@1f,0/pci@1/pci@1/SUNW,isp2two@4/sd@6,0:f
```

```
boot extcd
```

Go through the format procedure to enter the following partition information. Remember to "label" the disk in the partition menu AND in the format menu. If you do not label the disk in the format menu, then the partitioning will not be completed correctly.

Format Partition Information: Format the hard disk drive in the workstation. The following recommendations are for a small outpatient facility with 1 *RI* workstation and 1 or 2 scanners. Additional disk space can be added for larger facilities. Contact technical support to customize the configuration for your particular facility. Partition a 1.0 GByte hard disk as follows:

Database Server

a	32MB	/	(UNIX root partition)
b	128MB	Swap for 64MB RAM	(256MB for 128 MB RAM)
c	1002MB	Entire Disk	
d	recommended + 75MB	/opt	(Solaris packages & Rational Imaging)
e	100MB	/db	(database files)
f	recommended	/usr	(UNIX programs)
g	24MB	/export/home	(user accounts)
h	remaining	/img	(image partition - remainder of disk)

UNIX Software Selection: Load the UNIX operating system using the graphical interface and make sure to add the following packages by *customizing* the “End User System Support”:

- a) 4.1 Heterogeneous
- b) Audio
- c) Basic Networking
- d) Direct XLib
- e) OpenLook Include Files (Inside OpenWindows folder)
- f) On-line Manual Pages
- g) Point to Point Protocol
- h) Sun Fast Ethernet/FastWide SCSI
- i) System Accounting

When this section has been completed, UNIX Solaris should be installed on the workstation and "root" or superuser access will be available. Log in at the workstation's login prompt as root and complete the rest of the installation. The superuser account must be used to perform critical installations, as normal user's do not have sufficient permission to access the critical system files. You may perform the operations from the UNIX shell, or log into Open Windows to perform the following installations. Open Windows is recommended since you will be able to perform multiple functions at once in the graphical user environment.

D. RATIONAL IMAGING INSTALLATION

Use the following instructions to load the Rational Imaging packages from the installation tape.

Log in as **root** (superuser).

Start Open Windows by entering the following command at the UNIX prompt:

/usr/openwin/bin/openwin -noauth;

Open a commandtool to type in from the workspace menu under programs. Insert the *Rational Imaging* " **install jaz disk**" into the Jaz drive and mount it using the correct SCSI

ID of the Jaz drive. If you do not know the SCSI ID, use probe-scsi at the boot prompt to determine the ID or any conflicts with other devices.

```
mkdir /jaz ;
```

```
mount -F ufs /dev/dsk/c0t2d0s0 /jaz ; (for SCSI ID = 2)
```

Open the "console" and type the following commands at the UNIX prompt to add the ISTdb, ISTmain, and ISTri packages (and other additional packages that are required):

```
pkgadd -d /jaz/sol2/pkg ;
```

Select the numbers for **ISTdb**, **ISTmain** and **ISTri** packages **in that order**:

```
1) ISTdb723 ;
```

```
2) ISTmain ;
```

```
3) ISTri ;
```

These packages were designed to automatically install the selected components. Sometimes, depending upon which packages were selected, the postinstall scripts in the packages will specify additional installation procedures. Watch the screen for any recommendations. The ISTdb723 package requires the execution of "install_informix". The ISTmain package requires a script called "install_main", and the ISTri package requires the operation of the licensing facilities.

After installing ISTdb, ISTmain and ISTri, run the following script:

```
/opt/ISTri/install/install_informix ;
```

This script installs the Informix database software. Make sure that no errors occur during installation. You may wish to run "dbaccess" to ensure that the software is installed correctly. If any errors did occur, correct them by removing the package "pkgm ISTdb723", reinstalling the package "pkgadd -d /img/sol2/pkg", and executing "/opt/ISTri/install/install_informix". You do not need to reload all the other packages.

After ensuring that Informix has been loaded successfully, run the following script:

```
/opt/ISTri/install/install_main ;
```

This script will install the informix licenses, create the databases required for Rational Imaging, and initialize the tables in these databases for initial operation.

The following commands will enter the passwords for the various accounts. Enter the following commands and enter a password associated with each. Do not use the root password for these accounts.

```
passwd imaging ;
```

```
passwd informix ;
```

If no password is desired on imaging, then modify the **/etc/default/login** file and change PASSREQ=YES to PASSREQ=NO. Edit the **/etc/shadow** file and remove the password information between the first and second colons (":") for imaging.

Use the following command to license the executable applications from the ISTri package. Replace license_file with the correct name and path of the true license file. This file can be obtained from www.IntuitiveSoftware.com.

```
/opt/ISTri/bin/add_license < license_file ;
```

Modify the CMD_LINE parameters in the following files.

```
/usr/openwin/bin/textedit /opt/ISTri/bin/expire_locks ;
/usr/openwin/bin/textedit /opt/ISTri/bin/reset_modems ;
/usr/openwin/bin/textedit /etc/inittab ;
```

A sample of the inittab file is as follows:

```
r1:34:respawn:su - imaging -c "exec rconnect /img/incoming"
r3:34:respawn:su - imaging -c "exec rqueued >>&/opt/ISTri/log/inittab_riq.log"
r2:34:respawn:su - imaging -c "exec riupdate /img/incoming radiology"
r4:34:respawn:/opt/ISTri/bin/ridicomd -f -p 104 -t RI_DICOM /img/incoming
r5:34:respawn:su - imaging -c "exec riupdate -c /opt/ISTri/etc/adac_cfg /img/adac
radiology"
r6:34:respawn:/opt/ISTri/bin/ridicomd -f -p 105 -t RI_DICOM /img/adac
```

Check the following files to enable the redundant server. This will enable the nightly backup of the database server to another sun workstation, and facilitate tape backups of the database copy on each initialized tape. First, determine the redundant server. If this is the same system, then at least have ridundant and backup_radiology use a partition other than the normal /db partition (eg /img/db). This will maintain a copy of the database, and ensure the database integrity in the event of a catastrophe. If only backup_DATABASE exists in the /opt/ISTri/bin directory, then rename it to backup_**radiology** for the "**radiology**" database. If multiple databases have been created (unusual), then each database has to have a **backup_dbname** associated with it.

```
/usr/openwin/bin/textedit /opt/ISTri/bin/ridundant ;
/usr/openwin/bin/textedit /opt/ISTri/bin/backup_radiology ;
```

Exit OpenWindows and reboot the computer.

```
exit ; (select exit from the workspace menu)
reboot ; (at the login prompt)
```

The Rational Imaging system should be prepared at this point. Login using the account "imaging" which was created during the installation.

```
imaging ; (at the login prompt)
```

Check the window layout, the background color, and the main environment menu to make sure that the installation was successful.

Use the configuration button on RIlogin (the disk icon) to check the available applications.

V. Satellite Workstation

A. SUMMARY

Additional workstations can easily be added to the **Rational Imaging** system. These workstations will be able to perform all of the functions that the database server performs, such as importing images, reviewing diagnostic exams, and archiving. Configure each additional workstation as your needs required. Do you need an additional tape drive for dual tape backup? Do you need additional disk space for image storage? Is this workstation going to be in a different facility? These are questions which will influence the type of workstation purchased and the additional peripheral devices attached to the workstation.

We will assume for the purposes of this chapter, that the workstation is only going to be used as an additional visualization workstation, and that only additional disk space will be added for image storage. Since the database server has already been installed and is operational, we must configure this workstation to interact effectively with the existing network and with the existing patient database. Use the worksheets described in chapter II to acquire the appropriate information for this installation. Consult with our professional installation staff and your systems administrator whenever you are adding additional workstations to the network. An improperly configured workstation can confuse the network and halt the operation of ALL of the workstations on the network. Not only network operations may be affected, operational tasks requested of the workstations (such as scanning) may also not be able to be performed or will be very slow due to the network timeouts and CPU engaged in "fixing" this communication link.

Once you have determined the system parameters for this installation and they have been approved by Canon and your system's administrator, the installation process can begin.

Before you begin, make sure that you have the following materials:

1. **Sun Workstation to be installed**
2. **CDROM drive**
3. **Solaris CD**
4. **DAT tape drive or Jaz drive**
5. **SCSI cables**
6. **Tools**
7. **Rational Imaging installation tape or Jaz disk**
8. **Rational Imaging installation manual**
9. **Informix licenses (INET for satellite, INET & SE & ESQL for main and redundant server)**
10. **Rational Imaging licenses**
11. **APunix licenses (for DAT or JUKEBOX installations)**

B. SOLARIS INSTALLATION

This part of the installation will be pre-installed or will be accomplished by your *RI* representative in the event of a system or hard disk failure.

Install the hardware per the manufacturer's instruction manuals.

Follow the instructions for the **Main database server (page 14)** with regards to loading the Solaris operating system.

If this workstation is designated to be the redundant server (backup for the server database), then configure the /db partition to have the same disk space as the server.

If this workstation is not going to be a redundant server, then use the space allocated for the /db partition towards the /img partition. Do not create a /db partition unless this workstation is a main server or a redundant server.

C. RATIONAL IMAGING INSTALLATION

Use the following instructions to load the Rational Imaging packages from the installation disk.

Log in as **root** (superuser).

Start Open Windows by entering the following command at the UNIX prompt:

```
/usr/openwin/bin/openwin -noauth;
```

Open a commandtool to type in from the workspace menu under programs. Insert the *Rational Imaging* " **install jaz disk**" into the Jaz drive and mount it using the correct SCSI ID of the Jaz drive. If you do not know the SCSI ID, use probe-scsi at the boot prompt to determine the ID or any conflicts with other devices.

```
mkdir /jaz;
```

```
mount -F ufs /dev/dsk/c0t2d0s0 /jaz; (for SCSI ID = 2)
```

Open the "**console**" and type the following commands at the UNIX prompt to add the ISTsat and ISTri packages (and other additional packages that are required):

```
pkgadd -d /jaz/sol2/pkg;
```

Select the numbers for **ISTsat** and **ISTri** packages **in that order**:

```
1) ISTsat;
```

```
2) ISTri;
```

These packages were designed to automatically install the selected components. Sometimes, depending upon which packages were selected, the postinstall scripts in the packages will specify additional installation procedures. Watch for these recommendations during installation. The ISTsat package requires a script called "install_sat", and the ISTri package requires the operation of the licensing facilities.

After installing both of these packages, run the script:

```
/opt/ISTri/install/install_sat;
```

This script will install the informix license for INET and install the user accounts and local environments.

The following command will enter the passwords for the imaging account. Do not use the root password for these accounts.

```
passwd imaging ;
```

```
passwd informix ;
```

If no password is desired on imaging, then modify the `/etc/default/login` file and change `PASSREQ=YES` to `PASSREQ=NO`. Edit the `/etc/shadow` file and remove the password information between the first and second colons (":") for imaging.

Use the following command to license the executable applications from the ISTri package. Replace `license_file` with the correct name and path of the true license file. This file can be obtained from www.IntuitiveSoftware.com.

```
/opt/ISTri/bin/add_license < license_file ;
```

Modify the `CMD_LINE` parameters in the following files.

```
/usr/openwin/bin/textedit /etc/inittab ;
```

```
/usr/openwin/bin/textedit /opt/ISTri/bin/reset_modems ;
```

Check the following files to enable the redundant server. This will enable the nightly backup of the database server to another sun workstation, and facilitate tape backups of the database copy on each initialized tape. First, determine the redundant server. If this is the same system, then at least have `backup_radiology` use a partition other than the normal `/db` partition (eg `/img/db`). This will maintain a copy of the database, and ensure the database integrity in the event of a catastrophe. If only `backup_DATABASE` exists in the `/opt/ISTri/bin` directory, then rename it to `backup_radiology` for the "***radiology***" database.

```
/usr/openwin/bin/textedit /opt/ISTri/bin/backup_radiology ;
```

Exit OpenWindows and reboot the computer.

```
exit ; (select exit from the workspace menu)
```

```
reboot ; (at the login prompt)
```

The Rational Imaging system should be prepared at this point. Login using the account "imaging" which was created during the installation.

```
imaging ; (at the login prompt)
```

D. CONFIGURATION

The following modifications must also be performed to have the satellite workstation recognize the existing database, and have the other RI workstations recognize the existence of the new workstation. With the workstation on the network, it may be necessary to use remote shell "**rsh**" to perform some of these steps on the other workstations.

If the new workstation has been installed with a newer version of Rational Imaging than the main server, then you will either need to upgrade all of the existing workstations including the server to the current version, or you will need to bring this workstation's applications down to the prior version. The upgrade procedure is described in the next chapter. To downgrade the current version, copy all the files from the ISTri directory of the main server or another satellite station to the ISTri directory of this workstation.

```
rsh server_hostname ;
```

```

su ;
tar cpf /img/istri.tar /opt/ISTri ;
rsh new_host ;
su ;
tar xpf /net/server_hostname/img/istri.tar ;

```

Perform this step prior to any configuration because some of the files will need to be modified under this directory.

On the new workstation, the “*/etc/hosts*” file must be updated with each of the hosts on the network. On solaris systems, the file is “*/etc/inet/hosts*”. You can either use “vi” and enter these manually, or use “textedit”, and copy and paste the values from those found in the */etc/hosts* file on the server.

```

/usr/openwin/bin/textedit /etc/inet/hosts ;

```

You will also need to add the users to the “*/etc/passwd*” file and create their home directories on this system. Make sure that all the Rational Imaging workstations have the same list of users and hosts. Keep the userID, groupID, and IP addresses consistent. Use the following commands to add users to a Solaris workstation.

```

admintool ;                               (or useradd ; )

```

Modify the */etc/hosts.equiv* file to reflect all of the RI hosts on the network.

```

/usr/openwin/bin/textedit /etc/hosts.equiv ;

```

The following modifications should be performed on the **database server**.

Change to the “*/opt/ISTri/admin*” directory and use **risetup** add the host and image partition to the RI database.

```

cd /opt/ISTri/admin ;                      (/home/ist/bin = SunOS)
./risetup ;

```

Use **add_host** to enter the information for the new RI host.

Use **add_dir** to enter the information for the new image partition. These directories are automounted and should be accessed as “*/net/new_hostname/img*”.

Log in to EACH of the other RI workstations and complete the following:

Add the new hostname and internet address to the */etc/hosts* file.

Add the new hostname to the “*/etc/hosts.equiv*” file on each workstation.

Update the new users in the “*/etc/passwd*” file on each workstation.

This should complete the installation procedure for the new RI workstation. You may now login as “*imaging*” on the new workstation and update the Rational Imaging environment.

```

imaging ;      (at the login prompt)

```

Modify the environment for Rational Imaging as follows: 1) Close down any applications other than the *console* (Help, File manager...). 2) Enlarge the *console* window (so error logs can easily be visualized), and close the *console* to its iconic form. 3) Select *Properties* from the workspace menu and adjust the background color using the *custom* selection. A dark saturated hue is best for diagnostic imaging. 4) Select “*imaging*” from

the workspace menu and make sure that **rilogin** appears in the upper right corner of the screen. 5) With rilogin present, and the console closed on a dark background, select “**Save Workspace**” from the workspace menu under *utilities*. Each time you log in, the workspace will return to this initial setup.

Use the configuration button on RIlogin (the disk icon) to check the available applications.

VI. Multi-Database Connectivity

A. CREATING A NEW DATABASE

Rational Imaging allows multiple databases to be configured to separate departments, or to provide support for research, referring access or teaching files.

1. Creating a new patient database

To create a new database for these purposes, use the "create_db.sql" script as follows. If the database is on another server, make sure that the server is setup for a multi-server environment as described in the section "Creating Multiple Servers".

```
su - imaging
cd /opt/ISTri/install
vi create_db.sql (change the name of the database from radiology to another name)
cd /db (or user another database partition for the new database).
dbaccess - /opt/ISTri/install/create_db
chmod -R a+rw new_db_name.dbs
```

2. Making the database available to all users

Once the new database is created, you will have to make the database available through the "rilogin" database. Use "risetup" to add the new database and configure the hosts and image directories.

```
cd /opt/ISTri/admin
risetup
5) Add database access to rilogin
```

Enter the database name, the directory in the format "//hostname/db", and "n" if the database is not to be restricted (all users can access the new database). If you enter "y" to the restricted question, then you will be prompted to select a user for access to the database. You will need to run "5) add database" for each user to is to have access to the restricted database.

3. Allocating hosts and image directories

Use "risetup" to add hosts, users, and image directories to the new database as follows. Remember to enter the new database name when prompted by risetup. Also, you must add "imaging" to the new database at least.

```
Add user to rilogin (do this for all users who will use the database)
Add user to new_database (Add the "imaging" user).
Add user to new_database (do this for other users)
Add host to new_database (Add the hosts which will need access)
Add imagedir to new database (Add the image directories)
Add host to rilogin (Add the hosts which will need access)
```

WARNING: For hosts which share 2 or more databases, the new image directories MUST NOT be in the other databases. For example, if "/net/host/img" exists for

the database "radiology", then you must not use this for the new "cardiology" database. Instead, create a subdirectory under /img called "cardiology" and add the new image directory "/net/host/img/cardiology". It is by convention that we use the name of the new database "cardiology in this example" as the subdirectory under /img to separate the database image partition. We could have used "/net/host/img/radiology" as a convention for all the "radiology" databases, however most facilities will not use a multi-database environment, and thus the extra subdirectory would have needlessly extended the length of the image path.

Multi-database Schematic

Informix Server (se, sql, inet)

/db (database partition)

rilogin.dbs (Login database controls access to both databases)

radiology.dbs

host1

image dir (/net/host1/img) Most common image dir

image dir (/net/host1/img2)

host2

image dir (/net/host2/img/radiology)

teaching.dbs

host1

image dir (/net/host1/img/teaching)

host3

image dir (/net/host3/img) This dir is not in radiology

B. CREATING MULTIPLE SERVERS

Multiple Informix servers are similar to having multiple databases. There will be one or more databases supported on each server, and each database will be independent of each other when multiple servers are used. This is useful when the imaging databases are separated by critical communications lines, and require independent operation (eg: A T1 line connecting 2 hospitals). Rational Imaging allows 2 hospitals to have separate databases, each with independent central archives and a group of workstations displaying the images. In this scenario however, physicians must choose the correct database to access their exams. In addition, some users may not be given access to a particular database, while others may have full access. If the communications line is severed between the two hospitals, they will continue to operate independently, however the physicians at hospital A (database A) will not be able to access images from hospital B (database B).

Hospital A (Mercy)	Hospital B (Saint Luke)
Database A: Mercy	Database B: StLuke
Server: mercyserver	Server: stlukeserver
Informix sqlexec: sqlmercy port 1525	Informix sqlexec: sqlstluke port 1526
host: rr1	host: stluke1
imagedir: /net/rr1/img	imagedir: /net/stluke1/img
Archives: Primary, Secondary	Archives: SL_Primary, SL_Secondary

In the above example, physicians working on **rr1**, can log into **Mercy** to look at Mercy's exams, or they can log into **StLuke**, and access Saint Luke's exams. Similarly, physicians

at Saint Lukes working on **stluke1** can log into **StLuke** to access their exams, or log into **Mercy** to access Mercy's exams.

In addition, **Rllocate** can be used to **copy** exams from one database to the other database.

The normal ethernet conventions requiring unique IP addresses and subnets must be adhered to in these Wide Area Networks. The separate names for the archive sets (Primary and SL_Primary) are not required, however if the facilities should decide to centralize their databases in the future to 1 database, it will make things easier.

1. Informix configuration

In order for Informix to communicate independently with each server, the informix server process (sqlxecd) must be configured to run on separate ports on each server. Thus **Mercy** uses port 1525 (the default), and **StLuke** uses 1526.

This configuration is done to the **"/opt/informix/etc/sqlhosts"** file. Each line of this file specifies an alias for the server (usually just the hostname), the ethernet protocol (tcp), the actual server hostname, and the sqlxecd service name set up in the **"/etc/services"** file. In the above example, this file would look like the following:

The **sqlhosts** file on both mercyserv and stlukeserv would look like:

```
mercyserv tcp mercyserv sqlmercy
stlukeserv tcp stlukeserv sqlstluke
```

The **/etc/services** file on both mercyserv and stlukeserv would look like:

```
sqlmercy      1525/tcp      # Mercy's Server
sqlstluke     1526/tcp      # Saint Luke's Server
```

The **/etc/init.d/ri.install** on mercyserv would have the line:

```
/opt/informix/lib/sqlxecd sqlmercy &
```

The **/etc/init.d/ri.install** on stlukeserv would have the line:

```
/opt/informix/lib/sqlxecd sqlstluke &
```

Reboot the systems after these configurations have been made, or kill and restart the sqlxecd process.

In multi-server environments, the "rilogin" database may be independent for each facility, however both controlling login databases must have the same information for the databases, hosts, and users as specified in the following tables. These tables must be updated when new hosts, users or databases are added.

Users (add all users who need access to each database)

Host (add the hostname of each RI workstation)

Databases(add database access)

2. Unix configuration

Other than the **/etc/services** file (used for configuring the informix sqlxecd process), each of the following files must also be configured for each workstation:

```
/etc/hosts      (must contain ALL hosts in the network)
/etc/passwd    (use admintool to add all users to each workstation)
/etc/hosts.equiv (must contain all RI workstations)
/etc/services  (see previous section)
/etc/init.d/ri.install (see previous section)
```

3. Rational Imaging configuration

The application licenses must be added to each of the rilogin databases:

```
setenv RILOGDB //server/db/rilogin
```

```
add_license < license_file
```

The following files must also be checked to make sure that they are configured correctly. Each will specify a database and other configuration parameters which may need to be modified in the multi-database environment.

```
/etc/inittab
```

```
/opt/ISTri/bin/reset_modems
```

C. COPY EXAMS BETWEEN DATABASES

Rllocate can be used to copy exams from one database to the other database. The two exams once separated, will be treated independently (e.g.: print pages created after it has been copied, will not be available in the other database). This is useful, however, when exams need to be sent to other Rational Imaging systems for a second opinion. It is also useful when one database has been used as an Emergency database (in use when a T1 communications line has failed), and then the staff wish to move the exams back into the working database once the T1 lines comes back up.

VII. Upgrading a Workstation

A. SUMMARY

This section describes the procedures involved in upgrading the Rational Imaging software on a workstation. Installation scripts have been created to automate this procedure, however in some cases, system configuration of new features may be required. Make sure to read the README file associated with each upgrade version. This file will specify the detailed upgrade procedures for each specific version. Follow the upgrades in order and **DO NOT SKIP** any upgrades, especially those that alter the database architecture. You can determine the current Rational Imaging version by viewing the `/opt/ISTri/bin/riVERSION` file.

B. SCHEDULE UPGRADE TIME

Notify the facility that you will be performing the upgrade. This involves sending them a list of the new features and upgraded capabilities. It will also allow you to schedule any downtime if this is required. Generally, if only the binary applications are being modified, then each workstation can be upgraded independently. Thus, only that workstation being upgraded will be out-of-use during the upgrade. However if the database architecture is being upgraded during the specific upgrade, then **ALL** the workstations must be upgraded and the entire system will be down until the work is complete.

C. BACKUP DATABASE FILES

Use the following instructions to backup the database files:

Log in as **root** (superuser).

```
cd /db;
tar cpf /img/db.tar *.dbs;
```

This command will archive all the database tables into a file called `/img/db.tar`.

D. BACKUP APPLICATIONS

Use the following instructions to backup the Rational Imaging application files:

Log in as **root** (superuser).

```
cd /opt;
tar cpf /img/ist.tar ISTri;
```

This command will archive all the applications into a file called `/img/ist.tar`.

E. BACKUP SYSTEM FILES

If you are upgrading from SunOS to Solaris, then you should backup the system files under /etc. Otherwise skip this section.

Log in as **root** (superuser).

```
cd / ;  
tar cpf /img/system.tar etc;
```

This command will archive most of the OS system files into an archive called /img/system.tar.

F. BACKUP USER TEMPLATES AND DEFAULTS

It is also usually a good idea to backup all of the user configurations and templates. Use the following instructions backup the Rational Imaging template files:

Log in as **imaging**.

```
cd /opt/ISTri/admin;  
risetup ;  
11) List users in rilogin and radiology ; (locate the template/default directories)
```

Log in as **root** (superuser).

```
cd /img ; (the root of the template directories)  
tar cpf /img/config.tar defaults templates;
```

This command will archive all the files in the /img/defaults and /img/templates directories into a file called /img/config.tar.

G. INSTALL NEW VERSION

Use this section of the manual in addition to the README file associated with each version. The README file will give last minute details which may require user intervention and post-install configuration procedures.

Rational Imaging versions starting with 3.2 have automated scripts which apply most of the upgrades. This section will describe this automated procedure. The manual procedure prior to this version is described in detail in the README file associated with each version “**upgrades/ver_x.x.x/README**”.

These upgrades pertain to Solaris systems only. SunOS systems should be upgraded to Solaris prior to upgrading the Rational Imaging software in the facility. If this can not be done and the upgrade is required, then use the README instructions to upgrade the system with the SunOS binaries.

Use the following instructions to upgrade the Rational Imaging packages from the installation disk.

```
Log in as root (superuser).  
/usr/openwin/bin/openwin -noauth;  
cd upgrades/ver_x.x.x/patch;
```

./riupgrade ;

The riupgrade script will detect whether the system is a Main or a Satellite workstation and apply the appropriate upgrades. For manual installations, remember to use the next section and apply the SQL upgrade scripts “*dbaccess radiology upgrade_db*”.

Warning: If the database has been moved out of the /db partition (to /img for example), then the database will need to be updated manually using the “upgrade_db” script.

This script will apply the database upgrades described in the following section if the server is detected correctly. This can be verified by watching for the commands “UPGRADING PATIENT DATABASE: radiology”. If these commands are seen on the server, then the upgrade has been performed successfully provided no warnings or errors are issued.

The riupgrade script will also apply patches to the main software and update the pkginfo information for Rational Imaging. It also stores new checksum information for each file and will allow the “pkgchk” procedure to verify the integrity of the packages.

pkginfo grep IST ;	(look for IST packages)
pkginfo -l ISTri ;	(list complete information)
pkgparam ISTri ;	(list upgrade information)
pkgchk ISTmain ;	(check package integrity)
pkgchk ISTri ;	

These commands are very useful to check the Rational Imaging packages, however if partial upgrades have been applied (beta-test inter-version application upgrades), the pkgchk may report some minor errors or discrepancies with the program checksums.

H. DATABASE UPGRADES

Many of the Rational Imaging upgrades slightly modify the architecture of the patient database in order to allow new features or optimize previous functions. These upgrades require the operation of “dbaccess” to run a SQL script called “upgrade_db.sql”. This script will automatically apply all of the database upgrades required.

If “riupgrade” was used in the previous section, then it automatically detected the server and applied the appropriate database upgrades. You can skip to the next section if riupgrade successfully detected the SERVER and applied the dbaccess script to the patient databases.

The following instructions are for manual upgrades only, or where “riupgrade” failed to detect the server.

Log in as imaging	
cd ver_x.x.x ;	(on the upgrade disk)
ls /db/*.dbs ;	(list patient databases...radiology)
dbaccess /db/radiology upgrade_db ;	
dbaccess /db/other_db upgrade_db ;	

Perform the last step for all the patient databases. DO NOT perform upgrade_db on the rilgin database. This is a system database and not a patient database.

Dbaccess alters the permissions of the database files, so to make sure that everyone has read/write permission, issue the following command:

```
cd /db;
chmod -R a+rw radiology.dbs;
chmod -R a+rw other_db.dbs;
chmod -R a+rw rilogin.dbs;
```

Issue the last command for each of the patient databases and for the rilogin database. These commands are very important, as the database archive may not function properly if read/write permissions are not set correctly. The initialize tape function and copy_db procedures may also fail and the redundant database will be compromised.

I. CONFIGURATION

The *riupgrade* script will automate most of the configuration required. Check the README file to make sure that the configuration has been applied successfully, or whether there is additional configuration required.

It is always wise to check the configurable files and make sure that they have not been altered. The following list of files should be checked to make sure that the variables are set correctly (database and server name vary from facility to facility):

```
/etc/inittab
/opt/ISTri/bin/ridundant
/opt/ISTri/bin/backup_radiology
/opt/ISTri/bin/backup_otherdb          (if any other patient databases exist)
/opt/ISTri/bin/expire_locks
/opt/ISTri/bin/reset_modems
```

J. TESTING

If any errors occurred during the upgrade procedure, report them immediately. Partial upgrades may affect the integrity and operation of the imaging system.

After successfully upgrading the system. Run all of the applications to ensure that they perform properly. Especially, test the “ridundant” script on the server to make sure that the redundant copy of the database is being updated correctly.

```
cd /opt/ISTri/bin
ridundant
```

Watch for any errors from this script and make sure that the backup database on the redundant server is copied correctly. Check to make sure that the disk space for the database partition (under /db) is sufficient.

Notify the facility to report any irregular behavior or problems that may be a result of the upgrade.

VIII. Tape Backup Device

The following instructions will show how to install an archive tape drive onto a Rational Imaging workstation. Make sure that you have the appropriate license information before proceeding with this installation.

A. SOLARIS INSTALLATION

Make sure that the tape drive is recognized by the workstation. If the drive was not on during the Solaris installation, then reboot the computer using “reboot -r” with the power on the drive.

Obtain the appropriate DAT license information prior to installing this package.

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTarc from the list of packages on the tape as follows:

```
su ħ
pkgadd -d /dev/rmt/0n ħ
select the number for ISTarc ħ
```

It may be required to run the install_juke process with imaging’s environment.

```
csh ħ
source /home/imaging/.cshrc ħ
cd /opt/ISTri/install ħ
install_arc ħ
```

The post-installation script will run a program called **apinstall**. Click on the “Apunix HP DAT drivers” and then click on “**Start Installation**”. Enter the license information when prompted to do so.

Reboot the computer to make sure that the new drivers are recognized and working properly.

B. TESTING

The following instructions will test whether you can obtain the status of the tape drive, rewind the tape drive, and read and write information to the tape drive. If your drive was installed in the secondary tape position, then use “/dev/nrcht1” in place of “/dev/nrcht0” for all the commands below.

1. Tape status

Turn the tape drive ON, insert a blank tape into the tape drive, and enter the following command at the UNIX prompt:

```
mt -f /dev/nrcht0 stat
```

The tape drive should respond with status information and should not report any errors.

2. Rewind the tape

Enter the following command at the UNIX prompt:

```
mt -f /dev/nrcht0 rew
```

The tape drive should not report any errors. You can obtain the status of the tape again and the file no should be set to 0.

3. Write some information to the tape

To test the read/write capabilities of the drive, make sure that the write-protect tab on the tape is in the OFF position and enter the following UNIX commands:

```
tar cvf /dev/nrcht0 /etc/hosts
```

The tape drive should respond by archiving the "hosts" file and displaying the filename when it has archived it.

Rewind the tape and list the tapes directory by using the following command to ensure that the write process was successful:

```
mt -f /dev/nrcht0 rew  
tar tvf /dev/nrcht0
```

4. Eject the tape

To eject the tape, you can either press the button on the front of the tape drive or enter the following UNIX commands:

```
mt -f /dev/nrcht0 off
```

The proper operation of these commands is imperative if the Rational Imaging archiving applications are to function properly.

C. CONFIGURATION

Use risetup to have the new tape drive recognized by the Rational Imaging system.

Log into the database server, change to the /opt/ISTri/admin directory, and run risetup. Then use the option to add a new tape drive. Use the defaults whenever you have a question about the parameters.

```
cd /opt/ISTri/admin;  
risetup ;  
add new tape drive ;
```

The tape space parameter is the maximum Mbytes on a single tape. Use the following table for the correct parameter for DDS2 tape drives (Model 1533A).

Length	Compressed MBytes
60m	2600

90m	3000
120m	6000
125m	18000

The archive applications will automatically detect the end of media, so entering too large a value will not affect the reliability, it will only make the tape space gauge inaccurate. Entering too small a number will cause the archiving mechanism to stop prior to the end of the tape, and thus some tape capacity will be wasted.

IX. Jukebox Installation

Follow these instructions to install a jukebox on a Rational Imaging workstation running SunOS. Make sure that you have the license information for the jukebox drivers prior to installing these drivers.

Install and configure the tape drives and jukebox parameters per the instruction manual from the manufacturer. Specify SCSI ID's for the tape drive(s) and the jukebox robotics which are not used by other devices on the workstation. Use "probe-scsi" at the boot prompt to determine the scsi ID's which are currently in use. ID's between 4 and 6 are recommended. Remember to jumper the HP drives (Target 4=jump 2) (Target 5=jump 2 & 0). Set robotics handler as 6.

A. HARDWARE CONFIGURATION

Use the following settings as examples for setting up the Qualstar Jukebox. For more complete information, see the Qualstar technical manuals.

Handler,
 Busy - Wait
 Door Open - Abort
 Filter Days - 120 Days
 Inventory
 Invalidate - Sentry
 Power On - Invalidate
 Source Drive - No
 Source I/O - No
 Mechanic
Model TLS-24144 (4420 on AIT Juke)
BCR - None
 I/O Port - A
 Mode - Random
Seq Drive - D1
First Location - A01
Last Location - 4B13
Number of Cartridge - 144
 Power On Clear - Yes
 Use Private Slot - Yes
 I/O Port
 Call Key - 1 Min
 Export - Yes
 Extended - Not Ready
 Import - Yes
 Import Scan - Yes
 Slot Access - Both
Drive D1- Sony SDT-9000 (Sony 500 AIT2)
Drive D2- Sony SDT-9000 (Sony 500 AIT2)
 Log (all ON)
 SCSI

Data Phase - Single
Different - NO
 Disconnect - ON
 Drive Bus
D1 - This Bus
D2 - This Bus
 Drive IDS
D1 - Random ID 4
D2 - Random ID 5
 DT access - Ejected
 Element
Drives - 2
 Fixed Slot - 6
 I/O Port Yes
Slots - 144
 Emulation
 Exabyte 10e, 10i, 120, 210, 440, 480
 Native

 Enable
 Err: Native
Handler ID - 0, LUN - 0
 Inq - Native (string , Qualstar TLS 24144, 1.51)
 Mode Parameter
 Element Add
 LCD Display
 Parity - Abort
 Storage Order - Mag
 Synchronous - OFF
 Volume Tag Pad - SPC

B. AIT DRIVE PREPARATION

The following 2 sections are in regard to the new Qualstar AIT Jukebox. The Sony AIT drives are no longer Single-Ended SCSI. Rather, they are Differential Low Voltage devices, and require a LVD SCSI card and some additional installation steps. If you are configuring a DAT Jukebox with either HP or Sony DAT drives, please skip the next 2 sections.

Before proceeding with the drive installation, check the jumpers on the back of the drive(s). Failure to do this will result in "probe-scsi-all" command at the OK prompt to not see the drive(s) and the changer target Ids. Recommended target ID's for the drives are 4 and 5. The changer should be 0.

AIT2 switch settings should be:

all down except for S7.

AIT1 switch settings should be:

1,2,3,4 and 7 in up position and the rest in down position.

If "probe-scsi-all" returns a Sony tapedrive of type 300 instead of 500, the tapedrive is set to emulate an AIT1 drive rather than an AIT2 drive. To correct this, pull out the drive and correct the dip switches.

C. DIFFERENTIAL LOW VOLTAGE SCSI CARD (INSTALL NOTES)

The first thing to mention is that the new Sony AIT2 tapedrives are Low Voltage Differential (LVD) SCSI devices, and unlike the Sony DAT drives which are Single Ended SCSI devices, only one LVD can be properly connected to the SunSwift PCI SCSI card, and even in this case the cable length from the Sun to the Juke should not exceed 3ft. Longer length cables or the presence of more than one drive will cause the reduction in SCSI transfer rate and the disabling of the wide SCSI mode during bootup by the Sun SCSI controller. The only solution to this problem is to use an LVD SCSI controller instead of an SE type SCSI controller. After talking to Qualstar, we decided to try the new **Antares Ultra2-Wide PCI LVD SCSI controller (part # p0068)**. A 6ft cable can be used with this controller.

Before proceeding with the card installation, on the Jukebox side, check and set the jumpers on the back of the drive(s) as well as on the front panel. Failure to do this will result in "probe-scsi-all" command at the OK prompt to not see the drive(s) and the changer target Ids.

On the **Antares card** there are 3 switches which should be set so that the termination on the card side is enabled. The default setting is for **1 and 3 to be in up position and for 2 to be in down position**. This is the correct setting for enabling termination on the Sun units running Solaris.

On the jukebox make sure that you have an appropriate **multimode terminator**. A multimode terminator should be provided by Qualstar and it should have a writing on it saying "LVD-SE". The single ended Sun or other terminators will not work.

The correct installation steps for the Antares card are as follows:

1. Install the card in an empty PCI slot.
2. Boot up the system, login as root, insert the included floppy and type "volcheck" to tell the system volume manager to look for the floppy.
3. Use the included floppy disk to install the basic drivers for the card, but instead of following the steps in the install guide which is incorrect, simply copy the floppy contents into a newly made directory, then go to the /floppy/floppy0/Solaris/2.6 and use "pkgadd -d ANTRglm2.sol26" to install the driver package.
4. Now you can use the standard procedure to install the juke package and enter the appropriate licenses and serial numbers obtained from apunix. Please note that the existing Sony DAT drivers as well as the existing changer drivers work fine with the new AIT1 and AIT2 drives, and even though Apunix has a driver named Sonyait in their website, this is the same SonyDAT driver with only a new name. Please be aware that as of now, Solaris 7 does not see the changer driver and thus the juke systems should have Solaris 2.6 on them.
5. Reboot the system with reconfigure option (-r).
6. After the system comes up make sure that the apunix drivers (nrcdt0, nrcdt1 and ch0) are symbolically linked to the correct AIT devices by the following commands:

```
cd /dev
```

```
ls -al nrcdt0
```

```
ls -al nrcdt1
```

```
ls -al ch0
```

If there is any problems, make sure that the "probe-scsi-all" at the OK prompt sees the devices. Also make sure that the scsi cable is securely connected on both end. This is important since the apunix wide to wide scsi cables have pins that are a bit more recessed than the same type sun cables. Failure to securely connect and tighten the cable will cause intermittent connection problems.

D. SOLARIS INSTALLATION

Make sure that both the jukebox and tape drive(s) are recognized by the workstation. If the drives were not on during the Solaris installation, then reboot the computer using "reboot - r" with the power on. Also the ISTarc archive package should also be installed prior to the ISTjuke application.

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTjuke from the list of packages on the tape as follows:

```
su %  
pkgadd -d /dev/rmt/0n %  
select the number for ISTjuke %
```

It may be required to run the install_juke process with imaging's environment.

```
csh %  
source /home/imaging/.cshrc %  
cd /opt/ISTri/install  
install_juke
```

The post-installation script will run a program called **apinstall**. Click on "APunix HP DAT drivers" and then click on Install. Enter the license information when prompted to do so. Repeat the installation for the APunix changer device.

Reboot the computer to make sure that the new drivers are recognized and working properly.

E. TESTING

The following instructions will test whether the changer device driver is operating properly.

1. Jukebox status

Turn the jukebox ON, insert a blank tape into slot 1, and enter the following command at the UNIX prompt:

```
change status
```

The tape drive should respond with status information and should not report any errors.

2. Insert the tape into the drive

Enter the following command at the UNIX prompt:

```
change 1 drive1
```

3. Move the tape from the drive to slot 2

To test the read/write capabilities of the drive, make sure that the write-protect tab on the tape is in the OFF position and enter the following UNIX commands:

```
mt -f /dev/nrcht0 off
```

Make sure that the tape has ejected before giving the next command:

```
change drive1 2
```

4. Eject the tape

```
change 2 door
```

Use the eject button to remove the tape from the security door.

F. CONFIGURATION

Use the configuration button on RIlogin (the disk icon) to add RIbox to the list of available applications.

Use risetup to have the new jukebox recognized by the Rational Imaging system.

Log into the database server, change to the /opt/ISTri/admin directory, and run risetup. Then use the option to add the new jukebox. Use the defaults whenever you have a question about the parameters.

```
cd /opt/ISTri/admin;
```

```
risetup ;
```

```
add new tape drive ;
```

```
add new jukebox ;
```

```
associate the tape drive with a jukebox ;
```

```
add available jukebox slots ;
```

```
associate a tapeset with a jukebox drive ;
```

Use the RIbox application to load the jukebox. The jukebox can be configured as a Primary, Secondary or Combined jukebox. The combined setting is only recommended if there are 2 drives in the jukebox. The initial and active tapesets will be assigned to be archived on separate drives. If only 1 jukebox is desired, then use an external tape drive for the Primary archive and take the tapes offsite as soon as they are full.

In RIbox, click on the Queue Status button and then on Stop Queue. Then click on Queue Status again to show the jukebox slots. Once the slots are displayed, click on the RECOMMENDATIONS button to have it configure and load the tapes. This button will be used for normal operation. The other functions are only to be used under abnormal conditions when the jukebox does not correctly recognize the state of the jukebox.

G. REMOVING EXISTING APUNIX DRIVERS

If you are upgrading the APunix drivers, or upgrading from DAT to AIT, you will need to remove the current drivers to perform a fresh install. To do this, use the following steps:

```
cd /opt/ISTri/archive/install
```

```
uninstall dt
```

```
uninstall ch
```

```
unlink nrcdt0
```

```
unlink nrcdt1
```

```
unlink ch0
```

X. Vidar Film Scanner Installation

Follow these instructions to install a Vidar XR12 film scanner on a Rational Imaging workstation running SunOS. Make sure that the Vidar scanner is on during this installation.

A. SUNOS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Retrieve the device drivers for SunOS from the vidar partition on the installation tape.

```
cd /home ;  
mt -f /dev/nrst0 fsf 3 ;      (skip to the correct tape partition)  
tar xvf /dev/nrst0 ;  
cd /home/vidar ;
```

Perform the installation per the instructions in the README and installation files under the vidar directory.

Reboot the computer to make this driver active. **WARNING:** Use the instructions provided in the System Maintenance section (page 98) regarding how to shutdown and reboot the UNIX workstation. DO NOT simply power cycle the computer.

B. SOLARIS INSTALLATION

Make sure that the Vidar scanner is recognized by the workstation. If the scanner was not on during the Solaris installation, then reboot the computer using “**reboot -r**” with the power on.

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTvidar from the list of packages on the tape as follows:

```
pkgadd -d /dev/rmt/0n ;  
select the number for ISTvidar ;
```

After installing the ISTvidar package, run the script “install_vidar”.

```
/opt/ISTri/install/install_vidar ;
```

Reboot the computer to make sure that the new drivers are recognized and working properly.

C. TESTING

Use RIsan to test the operation of the new scanner.

D. CONFIGURATION

Use the configuration button on RIlogin (the disk icon) to add RIsan to the list of available applications.

Remember to use add_license to license the use of RIsan properly.

XI. Modem Installation

Follow these instructions to install a modem on the Rational Imaging workstation. This will provide an important means of support for the network.

A. MODEM SETUP

Rational Imaging currently supports US Robotics Sportster modems of 28.8 baud or greater. The switches on these modems should be set as follows:

1. OFF Normal DTR
2. OFF Verbal results
3. ON Enable result codes
4. OFF Do not suppress echo
5. OFF Enable auto-answer
6. OFF Sends Carrier Detect
7. OFF Resets modem Y0 on power up
8. ON Enables AT command set recognition

To initialize the modem for **software flow control**, connect it to any SUN or PC

PC - install modem and run terminal program

SUN - connect modem and run "tip -38400 /dev/cua/a"

Enter the following commands to the modem:

AT␣ (modem should respond with **OK**)

AT &F1 ␣

AT X0 &A0 &K0 ␣

AT S0=1 S11=50 S12=50 S13=1 S19=15 &W ␣

AT I4␣ (check configuration)

These commands will prepare the modem for SUN communications and will save these instructions in the modems non-volatile memory. Thus, when the modem is turned off and then back on, the modem will be initialized correctly.

You can also run the application **"/opt/ISTri/bin/risetmodem"** to initialize the modem parameters. This will program the modem and save the configuration so that it will reset to the correct settings after each call and after recycling the power.

B. SOLARIS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTmodem from the list of packages on the tape as follows:

```
pkgadd -d /dev/rmt/0n;  
select the number for ISTmodem;
```

After installing the ISTmodem package, perform the following operations.

```
/opt/ISTri/install/install_modem;  
cd /opt/ISTri/admin;  
risetup;  
add user "telerad" to rilogin;  
add user "telerad" to radiology;  
passwd telerad;
```

Reboot the computer to make sure that the modem is recognized and working properly.

C. TESTING

Use tip to test the ability to dial out with the modem.

```
tip -38400 /dev/cua/a;  
at;  
atdt1-222-333-4444;      (test the connection with a know service)  
~.                      (to exit tip)
```

Use another computer and modem to test the dial-in capabilities. The new modem should allow you to dial in and login from another workstation.

Try to log in as "telerad" and make sure that RIaccess is activated appropriately. If there are no patients or database errors, then make sure the .cshrc has the appropriate references to the database server.

D. CONFIGURATION

Add a additional users as necessary to access the database remotely. The on-call accounts should be configured similarly to the "telerad" account.

XII. Raptor Video Card Installation

A. SUMMARY

This section has been added to supplement the installation instructions provided by Raptor. This video card offers a better solution for graphics display on Ultra 5 workstations with 1 monitor. It removes the hidden line erase artifacts that are present on the Sun m64 chip. It does have problems with 2 monitors however, as the cursor appears on both monitors. So only use this card on single head units.

B. INSTALLATION

Use the following instructions to install and configure the raptor video card in an Ultra 5.

1. Power down the computer and insert the raptor card
2. Reboot with `-r` to reconfigure the drivers
3. Insert the raptor CD, change to `/cdrom/cdrom0`, and run the script `“./install_all”` as root.
4. Halt the computer
5. At the OK prompt, enter `“setenv pcib-probe-list 1,3”`
6. At the OK prompt, enter `“reset”`
7. While the system reboots, change the monitor cable to the raptor card video out.
8. Run OpenWindows
9. In a commandtool, enter `“GFXconfig -depth 8 -res 1280x1024x76”`.
10. If the video appears correct with colors, click yes to accept the changes.
11. Save and exit this configuration application
12. reboot the computer and confirm that the video graphics are correct.

XIII. Display Calibration

A. INSTALLATION

Use the Sun manuals to install the SBUS video cards and the monitors to the Sun workstation. Then **install any additional drivers** necessary to make the monitor work under OpenWindows. The high-resolution greyscale monitors running on the DOME card require special drivers provided by Dome. Use the Dome manual to install these drivers, as each video card requires a separate set of driver applications.

Reboot the system using the "reboot -r " command so that the new devices are configured.

su

reboot -- -r (or "boot -r" at the boot prompt)

Edit the ".login" file of each of the users (imaging in particular - /home/imaging/.login) to add the second (or third) display. The syntax is as follows:

\$OPENWINHOME/bin/openwin -noauth -dev /dev/cgsix0 left -dev /dev/cgsix1 right

The first device configured on this line will be considered the console device by OpenWindows. If there are any problems getting the new monitor recognized by OpenWindows, use the dmesg command to check the device name, and the resolution of the display adapter. If the device does not exist, try the "reboot -r" command again to make sure that the device has been configured by Solaris.

dmesg | grep cgsix (replace cgsix with the name of the device if different)

```
cgsix0 at sbus0: SBus slot 2 0x0 SBus level 5 sparc ipl 9
cgsix0 is /iommu@f,e0000000/sbus@f,e0001000/cgsix@2,0
cgsix0: screen 1152x900, single buffered, 1M mappable, rev 7
cgsix1 at sbus0: SBus slot 3 0x0 SBus level 5 sparc ipl 9
cgsix1 is /iommu@f,e0000000/sbus@f,e0001000/cgsix@3,0
cgsix1: screen 1152x900, single buffered, 1M mappable, rev 11
```

If the video card is capable of higher resolutions than specified, see the dual_head script in the hardware section of the jaz installation disk to help configure the resolution for the video card (or contact the manufacturer of the video board). The particular card listed above is a TurboGX card with only 1M of RAM, so it can not display greater than 1152x900 resolution. A TurboGXplus card, however, has 4M, and can display 1280x1024.

B. CALIBRATION PROCEDURE

The Rational Imaging system has parameters which can be configured to help standardize the display of images across the imaging network. This means that the images should be displayed similarly on any monitor within the network. In order to achieve this while using different monitors (greyscale, color, hires, hiluminance), we have added configurable parameters to the database for each monitor. If these parameters have not been set, then default values will be used.

The first step is to determine the lowest black level where a 5% difference in contrast can be visualized. Each monitor (even of the same manufacturer) has a different Black Level below which no image information will be seen.

Turn off the lights (set the lights to **normal viewing conditions**)

ricalibrate & (run the ricalibrate program)

Use the mouse to stretch the ricalibrate window to cover most of the screen area. Drag it by the corners. Then click on the right mouse button over the ricalibrate window and select "**Black Level Test**". This will display a medium gray window with a cross-hatch image in the center. Use the left and middle mouse buttons to adjust the cross-hatch intensity till it is just visible. This will generally be a number between 2500 and 10000 depending upon the monitor. The value displayed up in the upper-left portion of ricalibrate is the number to use for the minimum black level when configuring the monitor parameters. If this value is set too low, then low image intensities will not be seen properly. And if the value is set too high, then the image will appear too bright and washed out. Click on the left mouse to decrease the intensity until the pattern disappears. Then click on the right mouse button several times until the pattern can be seen fairly well. You can run ricalibrate on both monitors at the same time to make sure that the cross-hatch pattern appears similarly on both monitors. Record the intensity for each monitor.

The next step is to add the new monitor parameters to the Rational Imaging system. Use the following procedure for each monitor within the system:

Login as imaging on the database server

cd /opt/ISTri/admin

risetup

42) Add monitor in database

host_key: (select the host_key for this workstation)

screen no: (0 is the left most screen)

minimum black level: (use the **intensity** you identified with **ricalibrate**)

maximum black level: (accept default 65535)

x: (bottom left x coordinate of screen relative to other monitors)

y: (bottom left y coordinate of screen relative to other monitors)

width: (width of display)

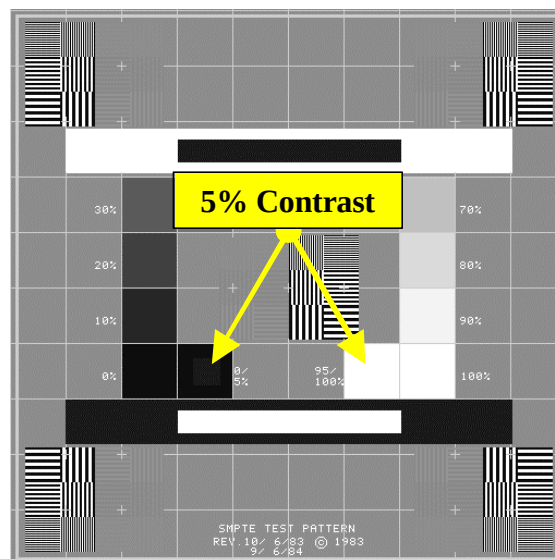
height: (height of display)

gamma: (Use 1.0 unless a densitometer has measured the linearity)

If these parameters are entered properly, then RView should be able to display all of the digital intensities within the SMPTE test pattern image or any diagnostic image.

C. SMPTE PATTERN

Display the SMPTE (Society of Motion Pictures and Television Engineers) pattern to make sure that the entire range of digital intensities is visualized. If this image is not on the system, you can import it from the GE scanners "camera", or drag it from the "installation jaz disk" onto the "drag-n-drop rectangle" in the upper right corner of the RIport application.



- Login as imaging
- Select RView from the program bar
- Click on Select Exam and select SMPTE or Camera to display the test pattern.
- Select the "Window/Level" mouse mode on the toolbar
- Double click over the image to set the intensity to: **L1024/W101**.
- Click on the View mouse mode and check the intensity ranges in the image

With RView displaying the image through these window/level settings, all of the digital intensities in the image should be visualized. A good test of this is the 5% square patterns in the 0% intensity and 100% intensity squares. You should be able to see these 5% regions on ALL monitors. The range of intensities and the visualized contrast between each 10% step should be similar in the white and black regions. You may want to create a copy of this window and move it to the other monitors so that you can check the calibration of all the monitors on the workstation.

If the 5% pattern in the black region can not be visualized under typical lighting conditions (used for primary interpretation with dimmed lights), then the minimum intensity is set too low. Go back into risetup and edit the monitors that can not display both the white and black 5% contrast patterns. Increase the minimum intensity until both can be visualized.

D. DOME MONITOR CALIBRATION

The following 2 sections have been added thanks to Bill Harris from Canon.

Check to see if the SMPTE or CAMERA images is listed in the patient list of Rview. If it is not, drag it from the Cdrom under images to the drag-n-drop rectangle of Riport. This will load it into the system. Or you can use Riport to get the CAMERA exam from a GE scanner.

Set all of the monitors to their factory defaults. On the Sun monitors, use the reset button. On the portrait monitors, you will need to adjust them to 60foot-lamberts.

Open the File Manager on the portrait monitor and Drag the DOMEcalib file from the DOME directory to the /opt directory on the Sun. Attach the Suction cup to the dome video card. Click on the DOME calib application and place the suction cup in the center of the

white box on the screen and click OK. Next choose the White Level Test. Here is where you need to set the white level to 60 foot-lamberts. You will need to adjust the contrast and brightness to achieve the correct value. Once you reach the correct value, check the black level. It should be 0.23 foot-lamberts. Click on the next button and the calibration procedure will check the range of intensities and calibrate the video card for this particular monitor. Do this for all greyscale monitors.

E. ALL MONITOR CALIBRATION

Open up a command tool and type ricalibrate. Expand the window to cover the screen, and use the right mouse button to select **“White Line Pattern”**. This will test the electron gun alignment. You should see sharp clear lines with no color at the edges. Use the RGB alignment buttons to optimize the sharpness. You should not see any red or blue tint at the edges of the lines.

Then use the right mouse button to select the **“Black Level Test”**. Click on the middle mouse button to lower the intensity until the black is “Black” but you can still see the 5% grey grid. Perform this test in the ambient room light which will be used for reading exams. This value is normally around 3000 to 5000 depending upon the monitor.

Use risetup on the server to add a monitor (or edit a monitor) and change the black level to that determined in the prior step. Then confirm the operation of this setting by running a new Riview process displaying the SMPTE pattern. The 5% patterns should be visible both in the white and in the dark box (100 and 0 percent). Note: each time the monitor black level is changed, Riview must be run again to load the new value. If the black level is too low, the dark 5% value will not be easily visible. If the black level is too high, the image will not appear “black” and will look washed out. Make sure that the SMPTE image is displayed with all of intensities (Level of 1024 and Window of 101). This will ensure that you are seeing all of the available digital intensities. Print the image to test the printer calibration.

F. PRINTER CALIBRATION

Create a print page with the SMPTE images and make sure that the window/level settings on the print page have a level of 1024 and a window of 101. This print page should then display the entire range of digital intensities within the test pattern.

Print the print page to the available printers in the network on a regular basis to make sure that all of the intensities are visualized. If the 5% contrast regions can not be seen, or if any artifacts or streaks appear on the image, call your service engineer to calibrate the film or paper printer.

If all of the monitors and printers are calibrated in this manner, then the diagnostic images should appear similarly on each monitor and hardcopy throughout the network.

XIV.Canon Digitizer

A. SCANNER CONFIGURATION

Use the Canon CFS300 scanner manual and the menu options of the scanner to set up the following defaults. The **bolded parameters** will vary from facility to facility.

If you set up the IP address and hostname of the scanner and then save that, you can telnet in and set these parameters using the “diag” application. **Telnet to the IP address**, use “cfs300” as the username, “**canon300**” as the password, and then type “diag” at the prompt.

```
***** SET-UP INFORMATION *****
Interface Ttpe                : TCP/IP
LCD Contrast (1~8)           : 6
Alarm (OFF, ON)              : ON
35cm Width Pixel Size        : 175
30cm Width Pixel Size        : 175
28cm Width Pixel Size        : 175
25cm Width Pixel Size        : 175
20cm Width Pixel Size        : 175
18cm Width Pixel Size        : 175
Grayscale Depth(1,8,12bits)    : 12 bits
Data Output(Transparency,Density): Density
Grayscale Inversion (No,Yes)  : No
X-Axis Flip (No,Yes)          : No
Y-Axis Flip (No,Yes)          : No
LUT Type(Linear, SqRoot, Hist) : Linear
Scan Mode(Single, Multi, Barcode): Multi Film
Max Density Value              : 3.200000
Min Density Value              : 0.000000
Data Byte Order(LITTLE, BIG)  : LITTLE ENDIAN
Data Compression(NONE, JPEG)  : NONE
File Format(DICOM, JPEG, PGM)    : PGM
Network IP Address              : 192.1.1.2      (Scanner)
Network Host Name              : cfs300
Subnet Mask                   : 255.255.255.0
Default Route Addr.           : 192.1.1.1
Ether Port Type(AUI, RJ45)      : RJ45
Target IP Address             : 192.1.1.3      (Sun)
Data Transfer Protocol        : FTP
Port No                       : 21
FTP User Name                  : cfsscan      (user on Sun)
FTP User Password             : cfsscan!
PGM File Extension            : .pgm
Lock File Extension           : .lck
Filname Body Length           : 24
FTP Put Directory Name         : img      (linked to /img/scan)
```

Hard Disk Installed?	: Yes
Use Hard Disk Buffer?	: Yes
JPEG Chip Installed?	: Yes
JPEG Method	: Hardware JPEG
Barcode Reader Installed?	: Yes
Use Barcode Reader?	: No
Serial Number	: SN100009
Scan Counter	: 257
Barcode Study Number	: 200

The 175um pixel size specifies a (2032x2467) image. This is what is required to meet ACR standards for primary interpretation. If they are using the system for on-call work, it is preferable to reduce the matrix size to increase speed of transmission to the radiologist's home. Do this by changing the pixel size parameter to 350 (1016x1233).

$$14\text{in} \times 25.4\text{cm/inch} \times 1000\text{um/mm} / 175\text{um} = 2032$$

$$14\text{in} \times 25.4\text{cm/inch} \times 1000\text{um/mm} / 350\text{um} = 1016$$

B. SOLARIS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTscanc from the list of packages on the tape as follows:

```
pkgadd -d /dev/rmt/0n
select the number for ISTscanc
```

Enter a password for cfsscan which was created during the package add.

```
Password cfsscan
```

Reboot the computer to make sure that the modem is recognized and working properly.

If this host does not have INET, and will be forwarding the images to another workstation, use the following instructions. If this workstation does have INET, and will store the images locally in /img/incoming for riupdate to pick up, then skip to the next section.

Configure the file /opt/ISTri/bin/ritransmit to send the images to another workstation.

Then copy /opt/ISTri/bin/riceive to the other RI workstation and configure it there to receive the images from ritransmit.

```
rcp /opt/ISTri/bin/riceive remote_host:/opt/ISTri/bin
rsh remote_host
vi /opt/ISTri/bin/riceive
```

Enter the ritransmit script name "/opt/ISTri/bin/ritransmit" into the transmit script in configuration popup of Riscanc.

RIscanc will require licensing via a file in /opt/ISTri/bin if the informix inet application is not loaded on the system. Since riscanc will not be able to attach to the server without inet, it must be able to obtain licenses in the "/opt/ISTri/bin/.rilicense" file. The file structure is the same as the licenses received from the IST website.

Hostname Hostid ProgramName LicenseInfo

Make sure to remove any unnecessary lines from this file.

C. RISCANC SETUP

Riscanc is the scanning application which will receive the digitized films, associate them with a particular patient, and then add them to the Rational Imaging patient database. It was designed to work independently on a Solaris PC, and then transmit the images to a Rational Imaging workstation over ethernet. It can also be run on a Rational Imaging workstation and simply put the images into the /img/incoming directory to be loaded into database by "riupdate". Compression can be used to facilitate network transmission over low-bandwidth networks (ISDN or 256k Frame Relay).

The riscanc comes with default parameters, however some of them will need to be changed for a particular facility. Run riscanc and click on the config button to change these defaults:

Login as imaging

riscanc

config button

In the config popup, the following parameters need to be set:

Scanner hostname: Enter the hostname of the canon digitizer

Image dir: "/img/scan" Select a directory where the images will be sent from the scanner

Scan dir: "/img/incoming" Select the directory where the images will be transmitted to when the transmit button is clicked.

Transmit script: Enter the name of the unix script which will then take the images, compress them, and send them to a Rational Imaging workstation. If the workstation has "riupdate" running along with "inet", then this script is not necessary and can be left blank. **NOTE, make sure to leave this field blank if riscanc is running with Informix. Otherwise riupdate will not be able to recognize the images in the incoming directory.**

Edit the "/etc/hosts" file and add the canon digitizer host. Make sure that you can ping the digitizer when it is on.

su

vi /etc/hosts (add canon digitizer "cfs300")

ping cfs300

Configure the scan user "cfsscan" and the "img" directory

admintool (add cfsscan with a /home/imaging home directory)

mkdir /img/scan

chown imaging /img/scan

chgrp imaging /img/scan

chmod a+rwX /img/scan

ln -s /img/scan /home/imaging/img

Try to telnet to the workstation as "cfsscan" and change to the "img" directory. If you can do this, then the scanner will be able to deposit images there.

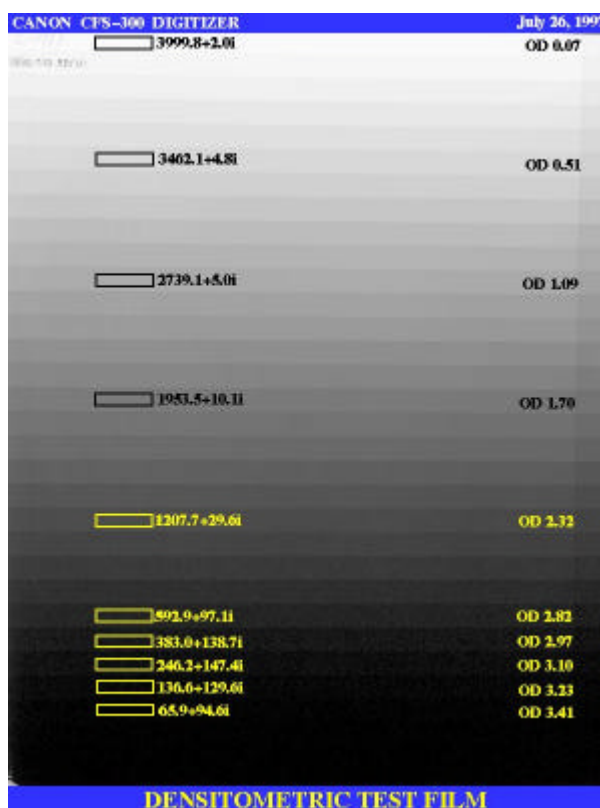
```
telnet rihostname
login as cfsscan
cd img
```

If a transmit script is being used to send the images to a remote Rational Imaging workstation, then make sure to edit the script and configure the parameters such as the hostname of the remote host and the directory to deposit the images. Also, you may need to add the Rational Imaging host to the /etc/hosts file.

D. CANON CFS300 CALIBRATION

The Canon CFS300 is capable of measuring optical densities throughout the diagnostic range. Normal films have optical densities in the range of 0 to 2.5. Over-exposed films require hot lamps to visualize the extended range of 2.5 to 3.5. The Canon digitizer is capable of digitizing intensities throughout this range (0-3.5), however the information content between 3.0 and 3.5 optical density units is questionable due to the extreme quantum limitations (Low X-Ray exposure results in high quantum mottle better known as noise). It may be better to set the limits of the digitizer from 0 to 3.0 based on a set of test results we will describe in the following procedure.

To measure the digitizer's linearity and range, obtain a **test film** which has calibrated optical densities from 0 to 3.5 OD. Set the scanner's **optical density range from 0 to 3.5**, and use **the linear transformation table**. Digitize the test pattern with sufficient spatial resolution (175 μ m or less) and display the resultant image in RView. The image should look like the image at the right.



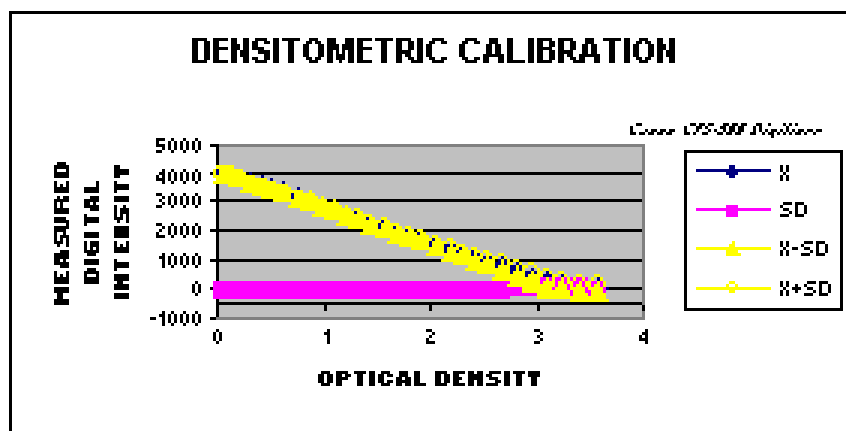
Change the mouse mode in RView to text mode, and select the intensity option. Then drag out rectangles within each densitometric step on the image. Make sure that the intensities are well within the step, otherwise the standard deviation and mean measurements will be inaccurate. You may need to change the window and level of the image to see the steps clearly. Changing these values does not affect the measurements, as the measurements are obtained directly from the 16bit original image. Once you release the mouse button, the mean and standard deviation will be displayed automatically. Use a densitometer (usually found in the dark room) to measure the optical densities of the steps.

Use a spreadsheet application to enter both the known optical densities (measured with the densitometer) and the measured digital intensity. This should give you a linear curve

unless the system is out of calibration. Also, the standard deviation should increase with optical density. At some point the standard deviation becomes greater than the expected anatomic contrast, and thus will limit the resolving power of the system.

Perform a linear regression on the measured data. The slope should be linear ($R > 0.95$) and should utilize the 12 bit dynamic range (y-intercept should be close to 4095).

The results of our CFS300 calibration procedure are shown in the following graph. This particular scanner demonstrated excellent linearity ($R = 0.997$) and used the entire dynamic range of the 12 bit data (y-intercept within 0.5% of the maximum intensity 4095). The regressions results were: $y = -1245.6x + 4075.5$. The x-intercept occurred at 3.27 OD.



OD	X	SD	X-SD	X+SD
0.07	3994.5	1.6	3992.9	3996.1
0.12	3935.3	3.1	3932.2	3938.4
0.21	3826.2	1.8	3824.4	3828
0.31	3699.7	1.7	3698	3701.4
0.42	3565.9	1.8	3564.1	3567.7
0.51	3449.5	2.1	3447.4	3451.6
0.62	3319.2	2.2	3317	3321.4
0.75	3164.7	2.7	3162	3167.4
0.87	2996.8	3.5	2993.3	3000.3
0.98	2855.5	3.7	2851.8	2859.2
1.09	2720.8	4.6	2716.2	2725.4
1.21	2562.6	4.5	2558.1	2567.1
1.31	2427.4	5.2	2422.2	2432.6
1.45	2249.2	6.2	2243	2255.4
1.58	2092.7	7.6	2085.1	2100.3
1.7	1924.2	8.8	1915.4	1933
1.81	1789.4	11.7	1777.7	1801.1
1.92	1660.6	14.5	1646.1	1675.1
2.06	1484.5	20	1464.5	1504.5
2.2	1312.4	23.9	1288.5	1336.3
2.32	1171.5	32.3	1139.2	1203.8
2.42	1045.1	40.2	1004.9	1085.3
2.54	897.3	49.8	847.5	947.1
2.69	738.4	74.4	664	812.8
2.82	584.4	99.2	485.2	683.6
2.97	383.5	143.2	240.3	526.7
3.1	230.3	147.2	83.1	377.5

3.23	122.7	123.2	-0.5	245.9
3.41	63.9	91.5	-27.6	155.4
3.57	37.7	70.8	-33.1	108.5

Additional calibration may be required to obtain a linear result. If this is necessary, follow the instructions in the Canon installation manual. It is our understanding that by entering the optical density and digital intensity for several points, the system can calibrate itself to provide a linear result. The exact calibration equations will be published in this section as soon as they are identified.

Caution: make sure that your data is accurate otherwise the calibration procedure may introduce non-linearities into the scanner which will alter the diagnostic content of the image. The CCD components of the system have an inherently linear response throughout the spectrum of visible light. Therefore, additional calibration should not be required.

This procedure will document the linearity and range of the scanner however, and will be a good reference if the quality of the images should degrade over time. Make sure that you document the following parameters:

- Optical Density Range (set in scanner)

- Image bits (16 should be selected)

- Resolution (175um recommended)

- Optical Density Values (Measured with densitometer)

- Intensity measurements (mean and standard deviation measured with RView)

XV. Disk Installation

The following section will describe how to add an extra disk to the Rational Imaging workstation for image storage.

A. UNIX PREPARATION

In order to add a disk to an existing Unix workstation, the SCSI ID must be set so that it will not conflict with the other devices. To do this, use the "probe-scsi" command at the boot prompt to see the existing devices.

halt (halt the workstation)

probe-scsi

Set the scsi id of the disk (with jumpers if necessary) to an unused value (Disks are usually between 0-3. The tape devices are 4,5. The CDROM is 6. The boot disk is defaulted to SCSI target ID #3. The Jukebox changer is usually set to 0.

Format the disk using the unix format command.

format

select disk

defects

extract original defects

quit

partition

enter the partition information (Split up large disks).

label

quit

label

(Make sure that you label the disk again in the main menu)

format

quit

Create a new file system on the partition.

newfs /dev/rdisk/c0t2d0s6 (Controller 0, SCSI target #2, Drive 0, Partition 6)

Make a new mount point for the image partition (/img2, /img3, ...)

mkdir /img2

mount -F ufs /dev/dsk/c0t2d0s6 /img2 (SCSI ID #2, Partition 6)

chown imaging /img2

chgrp imaging /img2

chmod 777 /img2

Add the following line to the **/etc/vfstab** file so the directory will be mounted at bootup.

```
/dev/dsk/c0t2d0s6 /dev/rdisk/c0t2d0s6 /img2 ufs 3 yes -
```

Export the filesystem so that other workstations can see it by adding the following line to the **/etc/dfs/dfstab** file. Run this command at the commandline, or reboot the system to export this filesystem.

```
share -F nfs -o rw /img2
```

B. ADDING TO THE RATIONAL IMAGING SYSTEM

Login to the database server and use "risetup" to add the new image directory.

login as "imaging" on the server

```
cd /opt/ISTri/admin
```

```
risetup
```

7) Add image directory to database

Use the convention (/net/host/imgdir/database). You can exclude the database portion if there is only 1 database (**/net/host/imgdir**).

C. TESTING

Login to another workstation and see if the image directory is available. If the other directories are currently exported to this workstation, then it may take some time to be recognized.

```
ls /net/newdiskhost/img2
```

XVI.Aspect DICOM Interpreter Installation

Aspect Electronics manufactures a DICOM Print Class SCP “black box” which will receive DICOM print pages and print them to older non-DICOM laser cameras (Kodak, 3M, etc). Check with Aspect for a list of supported cameras. This section is added to help install the Aspect interpreter. If problems occur, please consult the Aspect installation manual.

A. UPGRADING

The interpreter must be at version 3.05 or greater. If it is not, please contact Aspect Electronics to have them email the latest revision to you. You will receive an Interp.zip file, which you simply put on the configuration floppy in the root directory before configuration. We have added Version 3.05 Interp.zip to the Aspect directory on the IST Installation CDROM.

B. KODAK CONFIG PARAMETERS

The Kodak laser camera requires a dedicated digital interface on their laser printer to provide the connection with the interpreter.

The aspect installation floppy must be edited to prepare for certain printers. The following parameters may be used to setup for a Kodak laser camera:

```
AE_Title= Laser
Max rows=4800
Max columns=4096
Top margin=10
Digital_parity=even (even/odd/none)
Control=KCL (M952/P831/SPCI/KCL)
Baud rate=9600 (1200/2400/9600)
Parity_bit=none (even/odd/none)
Data_bits=8 (7/ 8)
Stop_bits=1 (1/2)
Media change-disable
Network address= (enter correct address)
```

On the Kodak printer, the configuration parameters were as follows:

```
Com. Port=2
Host protocol=KCL (Kodak Control Link)
Image data port id=1
Image parity=even
Com port parity=none
Data length=8
Baud rate=9600
Driver type=RS232
```

C. CONFIGURATION STEPS

Aspect's Interpreter is a box that takes as input DICOM images through its RJ45 ethernet input port, and converts the data into digital format used by non-dicom medical laser printers. The output ports of this box include a 37 pin data output named "PRINTER", a 9pin host control output called "HOST CTRL", and a SCSI II output port for scsi printer connections. There is also a 9 pin input port called "HAND CTRL" which is used for connecting an optional keypad for setup and configuration. Without the keypad, a floppy install disk must be prepared and configured.

The interpreter must be configured to the facilities network. The following instructions allow you to do this.

- 1) Put the Aspect system floppy disk in a floppy drive of your PC
- 2) Run "command" from the Start | Run menu on a PC.
- 3) Type "edit a:/system.ini"
- 4) Scroll down using the arrow keys until you reach the [network] section.
- 5) Modify the IP-address, the Subnet-mask, and the Router
- 6) Save the file
- 7) Remove the cover of the Interpreter and insert the floppy disk
- 8) Turn on the Power and wait until you hear 2 consecutive beeps
- 9) Turn off the Power, Remove the floppy and re-install the cover
- 10) Follow the instructions in the Aspect manual to install the printer cables.
- 11) Turn off the power on the Laser Camera
- 12) Plug in the network cable and turn on the power, first to the aspect (wait for the beeps), then on the laser camera. At this point there will be an active connection between the units.
- 13) Install RiprintQ and begin testing

XVII.RIS Connectivity Installation

Rilink and Rideliverd are background processes used in the **RIS connectivity** package. Rilink receives HL7 messages from RIS systems, and writes each message into a specified directory on disk. Rideliverd reads each message, and determines how to handle it based on the type of message. An ORU message is a report message containing a verified report, and rideliverd will try to associate the report with a matching exam. A ORM message, or general order message, is used to provide worklist (scheduling) information and also alter patient demographics. If everything works correctly, Rilink will receive and deposit the messages. Rideliverd will read each message, provide the functionality required, and then delete each successfully handled message. Thus the hl7msg directory should only provide temporary storage for messages being processed.

Rideliver is a third application in the **RIS connectivity** package which allows manual reconciliation of mis-matched reports.

A. LICENSING

The following licenses are provided when the “**RIS Connectivity Package**” is ordered:

```
rilink
rideliverd
rideliver
```

The following sections describe the installation and testing of each of these applications.

B. RILINK CONFIGURATION

Make sure that all 3 applications are version 5.1.0n or greater:

```
get_version /opt/ISTri/bin/rilink
get_version /opt/ISTri/bin/rideliverd
get_version /opt/ISTri/bin/rideliver
```

Create directory for temporary storage of messages:

```
mkdir /img/hl7msg
chmod 777 /img/hl7msg
```

Rilink is a background process run out of the inittab. Edit the /etc/inittab and enter the following line:

```
r7:34:respawn:su - imaging -c "exec rilink -d /img/hl7msg -i 5000 -n"
```

The following options are specified by default:

- d directory: Temporary message directory
- I port#in: Port number to receive messages on (Get from RIS vendor)
- n: Do not provide ACK message for each received message. The default mode is to provide an ACK message.

The following options are also available for troubleshooting:

- o port#out: Output port number if the ACK is to be sent
- f logfile: Specify logfile if run in verbose mode
- v: Verbose – output debugging information

Make sure that the rilink process is running. If it is not, see the troubleshooting section.

```
ps -ef | grep rilink
```

C. RIDELIVERD CONFIGURATION

Configure the rideliverd config file. There are several default files (for each RIS vendor) in the /opt/ISTri/etc. Copy the closest one to a new config file as follows (IDX assumed):

```
cd /opt/ISTri/etc
cp rideliverd_idx_cfg rideliverd_cfg
```

Modify the /opt/ISTri/etc/rideliverd_cfg file to suit the facility's needs. The following parameters are available:

Correct: Y	Specifies that the demographics should be corrected to match the RIS information (If N, the the demographics on the PACS will not be altered by Rideliverd).
DBalias:	Specify the database alias found in the rilogin "databases" table
Outfile:	Specify the name of the logfile
RISDir:	Specify the name of the temporary hl7msg directory (/net/host/img/hl7msg). Make sure that you specify the NFS format so that Rideliver can be run from ANY host to reconcile the messages.
Verbose:	Specify a number between 0 and 9. 0 is the least verbose, and 9 the most. The messages will be put to the Outfile. Errors will also be generated in the syslog.
WriteHdr: Y	For reports, include the HL7 message demographics in the header of the report. If the report already has a demographic header, you may set this to N.
HostOut:	Enter the hostname of the host to send Storage Commit messages to.
PortOut:	Enter the port number to send the storage commit messages to.
StorCmtDelay:	Enter the number of seconds to delay before sending the storage commit. Leave enough time to make sure that riupdate has processed the images. 600 is recommended.

- NoFileSleep:** Enter the time to wait if there are no files in the directory to process. This is usually set to 60 seconds. However, if IDX wants faster response time to Exam Display messages, this may be set to 5 seconds.
- PrefetchExamLimit:** Enter the total number of exams (starting with the most recent) to retrieve when a prefetch message is sent.
- PrefetchExamAgeLimit:** Enter the number of months to go back from the current date for retrieving exams. If this is set to 24, then only the last 2 years worth of exams will be retrieved. If this parameter is not set, then 7 years is assumed = 84.
- DefaultModality:** Enter the modality to enter in the worklist table if the modality is not specified in the message. Usually 34 “RG” is used. This will then fill the modality for Riscanc with “RG”.
- Field:** Each field statement determines the mapping of each parameter in the HL7 message. Each RIS vendor may have different configuration parameters. The following organization is specified after the Field parameter

FieldName – name of the parameter (syntax must not be changed)

SegmentName – name of the HL7 segment (OBX, OBR, PID...)

FieldPosition – position in the segment (begins with 0, 1, 2 where 0 is the segment name such as ORC)

SubFieldPosition – If the field is separated by ^ characters, then this value will allow you to specify sub-positions. If 0, then the entire field is used even though ^ may be present. (eg: If 2 is specified and the data contains “this^is^a^test”, then “is” will be used. If 0 is specified, then “this^is^a^test” will be used”

CharOffset – enter the character offset of the data in the field. This is used to locate a time in a combined date/time field. (eg: If “10241988 10:34” is the data, the a value of 9 would return “10:34”).

Format – The following formats can be used to read and convert the data.

0 – No format change

1: Name format (last^first^middle -> last,first middle)

2: Date Format (yyyymmdd -> mm/dd/yyyy)

3: Date Format (yyyymmdd -> yyyy-mm-dd)

4: Time Format (hhmmss -> hh:mm)

5: Time Format (hhmmss -> hh:mm)

6: Date Format (mm/dd/yyyy -> mm/dd/yyyy)

7: Date Format (mm/dd/yyyy -> yyyy-mm-dd)

8: Time Format (hh:mm:ss -> hh:mm:ss)

9: Time Format (hh:mm:ss -> hh:mm)

RIdeliverd is a background process run out of the inittab. Edit the /etc/inittab and enter the following line:

```
r8:34:respawn:su - imaging -c "exec rideliverd -c /opt/ISTri/etc/rideliverd_cfg"
```

Make sure that the rideliverd process is running. If it is not, see the troubleshooting section.

```
ps -ef | grep rideliverd
```

D. MESSAGE TESTING

Send the following messages and confirm the results.

1. ORM Message: (Scheduled Event)

Check to make sure that there is an entry in the radiology “worklist” table:

```
Select * from worklist;
```

Use RIsCanc to see if the worklist item is available for “Scheduled” backfill. Make sure that all elements are available.

Also check to see that an entry was added to the prefetch table.

```
Select * from prefetch;
```

Ridistribute can be configured to retrieve these exams the night before the exam is scheduled to be acquired. See the last section of this chapter to configure ridistribute for prefetch.

2. ORU Message: (Report Event)

Check to make sure that there is a report available for the associated exam. Load the exam in Riview, and then click the “Report” button. The report should be able to be viewed. If the report is not associated with the exam (not in the /img/exam_key/reports directory), then check the “reportqueue” manual reconciliation table in radiology

```
Select * from reportqueue;
```

If the report was sent here (help up due to a mismatch), use RIdeliver to list the report and match it to a correct exam. You should be able to view the report in RIdeliver. If you can not, adjust the config setting for “Report Segment: 5”. It should be 5, but some RIS vendors put the report in 4 (MedFax). If this still can not produce a viewable report, then edit the actual message file and look in the OBX segment for the report. It should be quite visible. Determine the field position, and adjust RIdeliver config and the /opt/ISTri/etc/rideliverd_cfg config file.

3. ZRQ Message: (Storage Commit sent by Canon Connector)

This message will be present in the /img/hl7msg directory until it is actually replied to. This will be N seconds after the message was sent as specified in the /opt/ISTri/etc/rideliverd config file.

When it is successfully handled, it will be deleted. Check the canon connector to make sure that it received and processed the storage commit acknowledgement. You can also check the `rideliverd.log` logfile specified in the config file.

4. EXM Message: (IDX request to display exam)

Check to make sure that an exam was launched (appears as an Riview icon at the bottom of the screen) on the specified workstation. The command used to launch riview may have permission problems, or maybe the unix user is not available on the remote workstation. Test the current workstation (server) if the exam is not displayed. You can test the command permission by executing the command manually (replace *server* with the real server, `##exam_key##` with the exam's database `exam#`, and *radiology* with the name of the database):

```
rsh -l username hostname "riview //server/db/rilogin ##exam_key## 1 0 //server/db radiology" &
```

Correct any permission problems.

If these messages were sent, `deliverd`, and produced the expected results, then you will not need to review the following sections.

E. RILINK TROUBLESHOOTING

Use this section to step through the processes and test or troubleshoot the applications.

To test Rilink, it is best to turn off `rideliverd`. To do this, change the "respawn" element in the `inittab` to "off".

```
r8:34:respawn:su - imaging -c "exec rideliverd -c /opt/ISTri/etc/rideliverd_cfg"
init Q
ps -ef | grep rideliverd
kill -9 ##rideliverd_pid##
```

Now send some messages from the RIS system. Do they appear in the `/img/hl7msg` directory. If not, turn off `rilink` in the `inittab` (similar to specified above only use the line for `rilink` and kill the `rilink` process). If they do appear, skip to the section on testing `rideliverd`.

Run `rilink` manually with the following options

```
rilink -d /img/hl7msg -l 5000 -f /img/rilink.log -n -v
```

This will put `Rilink` in verbose mode, and after you send a message, see if there is any useful information in the logfile. If no information is logged, then `rilink` probably is not receiving any messages and maybe the port number is wrong. You may see messages like the following during normal operation:

Incoming: 5000

Outgoing: 5001

New `rilink` process starting: 20296

Before while Mon Jul 31 14:28:39 2000 before accept

The previous lines show that `Rilink` is waiting for messages (accept). If messages should be recognized, the following lines will be logged:

After accept

```
Tue Aug 1 10:11:54 2000
Before Read: begin processing 208 bytes
Write file: /net/andromeda/img/hl7msg/rilinktmp.1
ORU Aug 1 10:11:55 2000
Done processing
Before Read.....
```

The previous lines show that Rilink received a 208 byte message on Aug 1 at 10:12 and wrote a message file for a ORU type message.

F. RIDELIVERD TROUBLESHOOTING

Use this section to troubleshoot Rideliverd.

To test Rideliverd, it is best to turn it off and run it manually. To do this, change the “respawn” element in the inittab to “off”.

```
r8:34:respawn:su - imaging -c "exec rideliverd -c /opt/ISTri/etc/rideliverd_cfg"
init Q
ps -ef | grep rideliverd
kill -9 ##rideliverd_pid##
```

With some messages in the /img/hl7msg directory, set the verbose mode in /opt/ISTri/etc/rideliverd_cfg and run rideliverd manually.

```
edit /opt/ISTri/etc/rideliverd_cfg
rideliverd -c /opt/ISTri/etc/rideliverd_cfg
```

Check the logfile specified in /opt/ISTri/etc/rideliverd_cfg to see what output may be useful. Make sure that the debug level is set to 9 to make sure to get the most amount of information. If the mapping is incorrect, record the RIS vendor, version number, and get their HL7 specs so that new mapping files may be created.

G. RIDISTRIBUTE PREFETCH CONFIGURATION

Ridistribute is used to handle the prefetch capabilities due to its versatile distribute capabilities and the ability to configure it to retrieve to a specified set of hosts based on available disk capacity.

The first step is to create a ridistribute configuration file for prefetch on the server (/opt/ISTri/etc/rid_prefetch). This should already be present and only require customization.

The elements of this file are as follows:

```
include(/net/server/img/ridistribute_defaults)
LockFile: /opt/ISTri/etc/.rid_prefetch.lock
SelDest: All
Process: Prefetch
```

The “SelDest” command may be altered to specify only certain hosts such as “All.Diag” or “All.BitBucket”. The include statement must point to the redistribute_defaults for the system disk configuration.

Once this config file is created, simply add a entry to imaging’s crontab to run redistribute and prefetch the exams based on the specified criteria (by Total Number, or by most current in months). Redistribute will add the exams to the “jukequeue” table which are scheduled for the next day. You can run redistribute manually “redistribute -c rid_prefetch”, and then run Ribox to see if any exams have been added to the queue.

To edit the crontab entry for imaging, login as imaging and edit the crontab using vi with the following statements (remember to use vi editing syntax):

```
Setenv EDITOR vi
```

```
Crontab -e
```

The entry in the crontab for prefetch is:

```
0 23 * * * exec csh -c "/opt/ISTri/bin/ridistribute -c /opt/ISTri/etc/rid_prefetch"
```

This will activate the prefetch process at 11:00pm (23:00) the night before.

The query used to activate the items in the prefetch table is:

```
Select * from prefetch where exam_date <= today+1;
```

H. STUDY CONTENT NOTIFICATION

IDX and possibly other RIS vendors are requesting exam status information from our PACS. The want to know whether the exam is on our system, whether it has been archived or not, or maybe the exam has been deleted and is no longer available. This is done through DICOM Study Content Notification. Each time a new exam is imported into our PACS, an entry is made in the “scnexam” table with the exam_key, exam Instance UID and other exam specific information. On a regular basis (usually every minute), riscn checks this table and will deliver the messages to the RIS vendor’s port. When successfully sent, the message will be deleted. The following notification events are currently logged and forwarded in riscn (Status – Description):

- 1) New exam imported into PACS
- 2) Exam archived and removed (Only available if retrieved)
- 3) Exam retrieved from jukebox and now available again
- 4) Tape removed from jukebox (exams only available via phone request)
- 5) Tape inserted back into jukebox (exams may be retrieved)
- 6) Exam Deleted before archiving (No longer available on the PACS)

If riscn is not configured, then the messages will be logged in examscn, and they will be deleted after 7 days from the time of insertion(see “Deleting Old Messages”). Also, Version 6.0.0 of Rational Imaging is REQUIRED for this functionality.

To configure riscn as a background process, add the following statement to /etc/inittab

```
r9:34:respawn:su - imaging -c "exec riscn -c RIS_AE -a PACS_AE rishost port# //server/db/radiology"
```

Then try adding exams, or archiving them, to see whether the SCN messages are being added to scnexam.

```
select * from scnexam;
```

After 60 seconds or so, the messages should disappear from scnexam and be recognized by the RIS system. If this is too quick, you can turn off riscn (change respawn to off in /etc/inittab, then “init Q”). Then when you add exams or delete them, you will see the entries.

In version 6.1.0, Riscn can not disable any scanners that SCN messages are not needed, or not wanted at the RIS system. This may include exams from another facility or remote scanner. To disable this scanner, simply add the scanner host key into the “disable_scn” table using the following SQL command in dbaccess:

```
Insert into disable_scn select host_key from host where alias="ScannerAlias";
```

Use the correct “ScannerAlias” which is already in the database. This is the scanner name which appears in the patient list under the Scanner heading.

If the host is disabled, all exams coming from this scanner will not generate SCN messages of any type.

I. RIDELIVER – MANUAL RECONCILIATION

If the reports are not getting assigned to the exam and Riview can not see them, then there is probably a problem with the exam accession number and MRN match. Exams which do not match EXACTLY, will be put in the table “reportqueue”. The application “rideliver” can then be run to manually match the report with the correct exam.

RIdeliver has a top panel which lists the reports in “reportqueue”. It shows report information such as Name, ID, Sex, DOB, Accession #, Exam Date. The bottom panel is the PACS normal patient selection window. It has tabs and search elements which will allow the user to locate the correct exam for a selected report.

If you simply select a report, RIdeliver will attempt to locate possible matches (MRN or Accession or Name matches). This will make it easier to find the mismatch, and deliver the report. To do this, simply select the correct exam, and then click “deliver”.

You can also view the report to check for additional information by clicking “view”. And if no match is found, or the exam has already been archived, then you may delete the report by clicking “delete”.

The current RIS report delivery mechanism requires that the exam not be archived until the report has been matched. Generally speaking, if exams are aged for 3 days before archival and removing, then the report needs to get back to the PACS in this time, and any manual reconciliation required must be performed before the exam is removed to tape. In the future when more RIS vendors support bidirectional HL7 requests for reports, then Riview will actually be able to query the RIS system for the report, and this storage mechanism will become unnecessary.

WARNING: It is also very important to only accept verified (signed) reports from the RIS. Let them know that we have no ability to update the reports if they have not been signed, and thus we may archive inaccurate information if the report has not been signed. The RIS vendors we have dealt with so far, have been able to only send reports when they are complete and verified. Also, educate the staff (technologists) as to the importance of accurate MRN and accession number information.

J. DELETING OLD MESSAGES (WORKLIST, PREFETCH, AND SCNEXAM)

On Canon PACS databases without RIS connectivity, the SCN (Study Content Notification) messages would build up and not be distributed. Even on systems with Rilink and Rideliverd enabled, there needs to be a way to delete the old worklist items, and prefetch entries from these tables.

This is handled in a stored procedure called “unlock_expired”. The normal purpose of this routine was to unlock exams whose locks had expired. Since it does this once a day in the cronjob “expire_locks” on the server, it makes a good place to put other periodic cleanup routines.

Unlock_expired, as it is distributed, will use the following SQL commands to delete entries in these tables.

```
delete from worklist where study_date < today - 14;
```

```
delete from prefetch where exam_date < today - 7;
```

```
delete from scnexam where inserted < today - 7;
```

You can check these tables to make sure that they do not contain “old” messages.

```
select * from worklist;
```

XVIII.RIqueryd Installation

A. FUNCTIONALITY

RIqueryd provides the Rational Imaging system with **DICOM Query/Retrieve** functionality. What this means is that other image display systems can query our database, get a list of patients currently on the system (not in archive), and transfer those exams for displaying within these remote systems. This interface is very important in that it gives universal (standard) access to images stored within our database. The query/retrieve functionality is only available in **Rational Imaging version 6.0** and above. For prior versions, please upgrade the Rational Imaging system software to version 6.0 before proceeding with the riqueryd configuration.

B. CONFIGURATION

There is one configuration required for riqueryd. It is “**riqueryd_cfg**” normally, and is located in **/opt/ISTri/etc**. However the filename and location are configurable. We recommend that riqueryd be run on the image manager, since the database operations can run more efficiently. However, it may also be preferable to use a clinical display workstation that is not being used to frequently. There is some processing required to prepare the patient lists and images for DICOM transfer to these remote workstations.

The format of the configuration file “**riqueryd_cfg**” is as follows:

```
database= //pacs1/db/radiology
debug= 0
idx= 0
AETITLE1= ae_title hostname comment port_number vendor
AETITLE2= CANON_QR pacs1 QueryRetrieve 5001 IST
AETITLE3= EFILM_SCP efilm-host RemoteViewing 4006 Efilm
```

Enter the correct database definition on the first line. If you are uncertain as to the syntax, make sure that riexamine can connect to it “**riexamine -d //pacs1/db/radiology**”. If this returns OK, then the syntax is correct.

If problems occur, the debug level can be set as high as 99 to enhance the verbosity of riqueryd. Increase the debug level, and then run riqueryd from the commandline (not from inittab) to see the associations occurring and any errors that may be generated.

If IDX is querying our database, then the current version requires idx=1 to be set. All other workstations should have this set to 0.

The following lines in the configuration file define the AE titles and workstations that are allowed to connect to this server. The first line is present to define the options. The second line defines the actual server configuration. For example, riqueryd will be running on pacs1, accepting requests for AE_TITLE CANON_QR on port number 5001. The rest of the information is to document the entry.

The next lines give each workstation authorization to connect and retrieve images. At least one definition of the server is required, and one line per remote workstation to allow query / retrieve operation. The client definitions define the Efilm AE_TITLE (set up in the process manager for Storage SCP), the hostname or IP address of the remote host, and the port number that the images will be received under.

You will also need to define a directory where riqueryd can store temporary images during the transfer process. This is because it will need to bring them over from one of our NFS mounted PACS workstations, and then process and transfer them out to the Query/Retrieve client. Simply use unix to create and set the permissions on this directory.

```
mkdir /img/query
chmod 777 /img/query
```

Once you configure the two AE title lines (one for the server, and one for the remote client), the client should be able to get the patient list. It is recommended that you test this by running riqueryd from the commandline, in verbose mode, with the priority set high to test this capability. This will help you troubleshoot any problems.

```
riqueryd -c /opt/ISTri/etc/riqueryd_cfg -d /img/query 5001
```

Once this process has been verified, you can use the next section to automate the installation and operation of riqueryd. This will maintain operation of the server even during reboots.

C. INSTALLATION

To set up the automated operation of riquery, you need to add the following entry to the /etc/inittab file. You will need to be root to make this entry. The entry for riqueryd should look similar to:

```
r8:34:respawn:su - imaging -c "exec /opt/ISTri/bin/riqueryd -q -c /opt/ISTri/etc/riqueryd_cfg -d /img/query 5001 >>& /opt/ISTri/log/riqueryd_log"
```

This line needs to be entered as one line. It can not be broken up into two lines. Make this change as follows:

```
su
vi /etc/inittab
init Q
```

The init Q is necessary to tell init to reread the config file and process the new changes. This is all that is required to install riqueryd. You may want to confirm the operation of the riqueryd process by using "ps -ef | grep riqueryd" to list the operating processes.

D. MULTIPLE DATABASES

In the event that the facility has multiple databases, and they want the ability to query/retrieve from each of these databases, just set up riqueryd with 2 separate configuration files, and run them on 2 (or more) port numbers. The following lines in /etc/inittab would allow Efilm (for example) to query from 2 separate databases. Just modify riqueryd_rad_cfg to point to the "radiology" database, and riqueryd_card_cfg to point to the "cardiology" database.

```
r8:34:respawn:su - imaging -c "exec /opt/ISTri/bin/riqueryd -q -c /opt/ISTri/etc/riqueryd_rad_cfg -d /img/query 5001 >>& /opt/ISTri/log/riqueryd_log"
r9:34:respawn:su - imaging -c "exec /opt/ISTri/bin/riqueryd -q -c /opt/ISTri/etc/riqueryd_card_cfg -d /img/query 5002 >>& /opt/ISTri/log/riqueryd2_log"
```

Each database needs its own configuration file and its own port number.

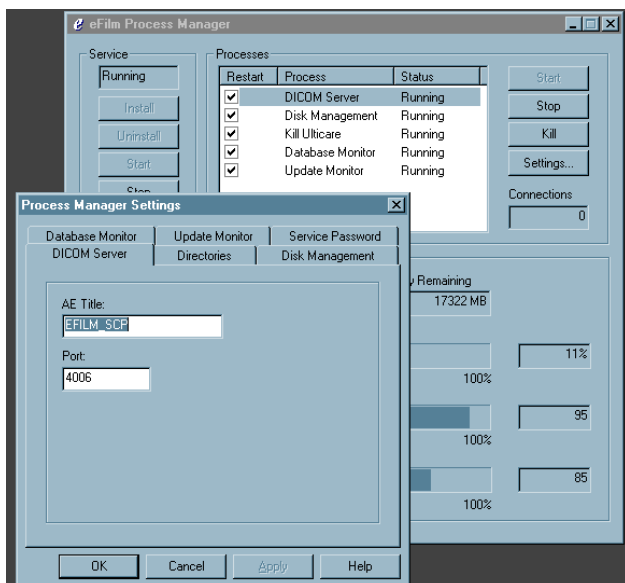
E. EFILM – INSTALL TEST CLIENT

To test the dicom query/retrieve, download the latest version of Efilm (www.efilm.net) and use this client to test the dicom transfer (both ridicom, and riqueryd). Download the executable installation script, and double click on it to install Efilm. Accept the default locations and configurations.

To configure Efilm, you must configure both the DICOM storage class to receive images, and the DICOM query/retrieve to search and request exams to be sent from RI to the Efilm station. Set up the dicom storage class first, and use Ridicom to test the transmission of an exam.

F. EFILM – CONFIGURE DICOM STORAGE SCP

Bring up the “Process Manager” from the Efilm menu (under the Start menu). Click on the DICOM Server, and select the “settings” button. Lets configure the AE_TITLE and Port number to “EFILM_SCP” and port “4006”. Click “OK” and answer Yes to restart processes. You can now quit the process manager. This will be started automatically each time you reboot.



Now we can test Ridicom to send an exam to Efilm. Bring up Ridicom and add a new destination. The new destination should have the correct information (Alias=efilm, Remote Host=64.249.104.194, Called AE Title=EFILM_SCP, Port=4006, Calling AE Title=RI_DICOM). Save the new destination.

Now select an exam (MR or CT preferably), select the efilm destination, and click on “transmit images”. Ridicom should process the images, send them, and then report “Transfer Complete” on the status bar.

You can now click on Efilm on the desktop of your PC, and then click on the “?” button to select the exam. It should be listed under the “Local Exams” tab.

G. EFILM – CONFIGURE QUERY RETRIEVE

You can now proceed to testing the Query/Retrieve capabilities. The first thing to do is to setup a Query/Retrieve server inside of Efilm. The following image shows the parameters required to setup this server. It requires a description which will appear on the Patient Select window, and the detailed parameters of the query/retrieve server. RIqueryd should be configured on the Sun workstation (usually the database server) to allow these queries as described previously.

RIqueryd requires 2 lines in its config file to allow the query retrieve to work for the host. The first line is to allow the efilm host to get a list of patients and identify the Query/Retrieve AE_TITLE (CANON_QR). The second line tells RIqueryd where to send the patient list and the images. This was set up previously as the storage class SCP (EFILM_SCP). The following line

should be in the /opt/ISTri/etc/riqueryd_cfg file to allow this host to get a patient list and retrieve images:

AETITLE1= CANON_QR andromeda QueryRetrieve 5001 IST

The other line that is required is a line which tells riqueryd that the Efilm host has authorization to receive images and on what port (This was configured in the previous efilm steps):

AE_TITLE2= EFILM_SCP efilm-hostname EfilmSCP 104 IST

This also supplies some security as every host which will have access to the database will have to have a line of “authentication” in this config file. This will help provide HIPAA compliance for security issues.

To set this configuration, go to “Edit | Properties” window. Click on the “destinations” tab, then enter the following information and add the query/retrieve server. You probably want to make this entry the “default” selection.

Click OK to accept these entries.

Now you can click on the “?” button, select “Remote Exams”, and list the exams. You may want to limit the list by entering “B*” into the patient name tab to list only the patient names that begin with “B”.

To transfer the exam, select an interesting exam, and click on the “retrieve” button. RIqueryd will then send the selected exam to the EFILM_SCP or port 4006 on the efilm client. The efilm network queue will appear and the status should change from “Pending”, to “Active” to ‘Idle’ at which point the exam had been completely transferred. The exam should not show up in the “Local Exam” tab in the patient selection window.

Description	AE Title	Hostname	Port	Type	Default
AndromedaQR	CANON_QR	64.249.104.195	5001	Server	Yes

Buttons: Add, Update, Delete, OK, Cancel, Apply, Help

Description	AE Title	Hostname	Port	Type	Default
AndromedaQR	CANON_QR	64.249.104.195	5001	Server	Yes

Buttons: Add, Update, Delete, OK, Cancel, Apply, Help

XIX.RIprintq Installation

RIprintq is a background process started out of inittab to allow the Rational Imaging applications to print to a DICOM print class provider laser-camera. It is controlled by a table in the database “printqueue” which contains entries for each printpage which needs to be printed. Each application (eg: RIview) will print a page to a known directory (temporary storage such as /img/print), and then create a timestamped entry in printqueue. RIprintq will print these pages on a first come-first served FIFO basis. Since multiple workstations may be printing at the same time, it will also try to keep the printpages for a particular exam together. However, if these printpages are being generated too slowly, it will not tie up the printer waiting for other printpages for a particular exam.

A. LICENSING

Each riprintq process supports 1 printer. Thus you must obtain licenses for each printer to be connected, even if riprintq is used on the same workstation. Contact Canon for these licenses and specify the number of printers to connect.

Also each riprintq application only supports one database. Thus licenses must be ordered for each database supported.

B. REQUIRED FILES

The application and sample configuration files already exist on a Version 4.0.1 workstation.

RIprintq will not work with versions before this since the required table “printqueue” does not exist on Version 4.0.0 and before.

There are two files required for RIprintq operation. The first is the application itself:

`/opt/ISTri/bin/riprintq`

The second is the controlling configuration file for riprintq:

`/opt/ISTri/etc/riprintq_cfg`

Enter the appropriate information into riprintq_cfg, and then specify this file on the commandline. The name of this file may be changed if multiple printers are supported from a particular workstation. The following command will start it manually. See the following section describing how to setup an inittab entry.

`/opt/ISTri/bin/riprintq -c /opt/ISTri/etc/riprintq_cfg &`

C. RIPRINTQ CONFIGURATION

The configuration file “riprintq_cfg” contains the following information which must be specified:

1. Database

Enter the database name in informix format “//server/db/radiology”.

2. Printer

Enter the printer alias which appears on the RIview printpage.

3. Host

Enter the hostname of the DICOM print class provider.

4. Calling

Enter the calling AE_TITLE of the Rational Imaging Workstation. The default is RI_PRINT

5. Called

Enter the calling AE_TITLE as specified by the DICOM host manufacturer.

6. Port

Enter the TCP/IP port number which the RIprintq application will listen and communicate on.

7. Sleep

Enter the number of seconds to wait before checking the printqueue table for new entries. The default is 30. If pages have just been printed, then the delay will be reduced to 0 seconds, and will gradually increase to the specified setting as contiguous checks return no available print pages to print. This way there will be minimal delay between successive pages.

8. MaxRetry

Enter the number of times to retry the print pages before giving up on it. If the printer goes offline, gets jammed, or is just busy at the time, this will allow riprintq to compensate. RIprintq will wait “Sleep” seconds before attempting to retry an unsuccessful page.

9. FilmMedium

Enter the acceptable film medium for the printer. The default is “BLUE FILM”.

10. OkFilmSizes

Enter the film size specifications (DICOM) which are acceptable to the printer. These will override the requested printed size specified by the print page. If the printer likes only blank film sizes, use “OkFilmSizes = BLANK”. If multiple sizes are ok, then enter both of them separated by a comma (no spaces) “OkFilmSizes = 11INX17IN,8INX10IN”.

A typical configuration file to connect to an Agfa printer will be as follows (The ‘=’ character is very important, do not exclude it):

Database = //pacs1/db/radiology

Printer = Agfa

Host = agfadicom

Calling = RI_PRINT

Called = ADVT

Port = 2104

Sleep = 30
MaxRetry = 3
FilmMedium = BLUE FILM
OkFilmSizes = BLANK,14INX17IN,8INX10IN

D. RIPRINTQ PRINTER ADDITION

Use “risetup” to install a DICOM printer (Option #8). The following options should be entered:

hostname: Same as Alias

alias name: Enter a name which will appear in the RView printer menu.

Printer Type: 8 (DICOM printer)

Printer Host: 0 (Not necessary)

Temp Dir: /img/print (Local Dir with a large amount of space is desired)

Width: 1400 (14” specified in 100th of an inch)

Height: 1700 (17”)

Resolution: 150 (Recommended – will result in 7.5MB image file – Printer may not support more than this)

Command: (Leave Blank)

Default JPEG: 75 (Does not effect printpage)

Print Pt Name: 1 (Print demographics on printpage)

E. RUN AS BACKGROUND PROCESS

The rprintq application should be started out of the inittab configuration file. Enter the “/etc/inittab” file and include the following entry. Make sure that the first 2 characters are unique and adjust them to make them unique.

```
r5:34:respawn:su – imaging –c “exec rprintq –c /opt/ISTri/etc/rprintq_cfg”
```

After editing this file and adding the rprintq line, issue the following command:

```
init Q
```

Then make sure that rprintq is running as follows:

```
ps –ef | grep rprintq
```

F. TESTING

Use RView to send a clinical or SMPTE printpage to the printer. Make sure that the printer alias is available in the RView printers menu, and that the resolution changes to 150 when this printer is selected.

If all is configured correctly, a printpage should appear on the designated printer. If not, start debugging the errors.

1) Is there a printpage in the /img/print directory. If not, maybe there is insufficient disk space

- 2) Is the rprintq process running “ps -ef | grep rprintq”. If not, there may be a configuration problem. Try starting it manually as described previously and check for errors. Use the verbose mode “-v” and you will see the results in the syslog error file.

```
rprintq -v -c /opt/ISTri/etc/rprintq_cfg
```

- 3) Does ritodicom add a correct header to the printpage file? Create a file named “**info_file**” to check this application. You will need to find the “exam_key” as the database exam number specified on the patient’s demographic page in RView. The width and height should be correct if you are using 150dpi for 14x17 films. You can get the image details from the printqueue table in radiology “select * from printqueue”.

```
Database = //pacs1/db/radiology
ImgFile = /img/print/Rlimag.#
OutFile = /img/print/DicomImage
ExamKey = 514
Width = 2100
Height = 2750
Depth = 8
Number = 1
```

Then run ritodicom as follows:

```
ritodicom -c info_file
```

If everything was configured correctly, a new file /img/print/DicomImage should be found in the /img/print directory. You can use DicomDump to make sure that the header is correct.

- 4) Does rprintd correctly print the file. Use the following syntax:

```
rprintd -c ADVT -p -t RI_PRINT -v dicomhost 104 /img/print/DicomImage
```

This application is run in verbose mode so that the errors can be detected. Try different calling (-c) and called (-t) AE_TITLES to see if the authentication is correct.

Try setting the filmsize and medium parameters and see if the dicom image will print them. If it does, then include the acceptable parameters in the rprintq_cfg file.

```
rprintd -a '14INX17IN' -b 'BLUE FILM' -c ADVT -p -t RI_PRINT -v dicomhost
104 /img/print/DicomImage
```

G. RESET QUEUE

Rlprintq has a commandline option to reset the queue (change the n_retry of all items to 0). This will allow pages which had errors to be printed. The commandline option is:

```
rprintq -c /opt/ISTri/etc/rprintq_cfg -r
```

The maintenance menu (under the OpenWindows main window) has a new option to “Reset the DICOM print queue” also.

H. DELETE PRINTPAGES IN THE QUEUE

Rlprintq has a commandline option to delete items in the queue. It will delete the printpages destined for the configured printer in “/opt/ISTri/etc/rprintq_cfg”. It will also remove the printpages from the “/img/print” directory. The commandline option is:

```
riprintq -c /opt/ISTri/etc/riprintq_cfg -d
```

The maintenance menu (under the OpenWindows main window) has a new option to “Reset the DICOM print queue” also.

XX. Blast Installation

Follow these instructions to install the blast package on the Rational Imaging workstation. This will provide an important means of distributing images over serial modems. The functionality added by this software allows Rlcall to transmit the images directly to a remote PC using a modem without having to dial-in to the system and download the images.

A. BLAST SETUP

First install the modem per the instructions in the previous section. Then use the following commands to install the blast software under the /opt/blast directory:

1. Log onto the workstation with the modem as “**root**”.
2. Change to the blast directory on the jaz drive.
3. Run the script “**install_blast**”. This will install the blast software. Install the blast software under **/opt/blast** and enter the **serial number** acquired from ProAmerica or IST.
4. Modify the “**.cshrc**” file in each users home directory (eg: /home/imaging) to include the following:

```
setenv BLASTDIR /opt/blast
```

```
setenv PATH ${PATH}:/opt/blast
```

Add the modem entry in risetup using

1. cd /opt/ISTri/admin
2. risetup
3. Select “46) Add modem in radiology”. Enter the information into the script. Use the defaults to guide your responses.

Finally, use Rlcall to enter the remote computers information and complete the installation.

1. Login as imaging
2. Make sure that “riqueued” is running on the workstation “ps -ef | grep riq”. If it is not, edit the “/opt/ISTri/bin/load_riconnect” file to enable riqueued and execute this script. Rlqueued is required for the modem queueing.
3. Run Rlcall.
4. Select an exam to display.
5. Click on “Send via modem”.
6. Click on “Phone Book” under the *send via modem* popup.

7. Enter the correct information for the remote receive station.

You have now completed the setup involved in preparing for blast.

B. INSTALLING HYPERTERM ON THE PC

To receive images from the Sun workstation, the remote computer must have a host communications package such as hyperterm (which comes standard with Windows 95). Run hyperterm to create a “Receive” icon which the physicians can run to receive images as follows:

1. Go to Start | Programs | Accessories | Hyperterm.
2. Run hyperterm.exe
3. Enter a name for the new profile “Receive Images”
4. Enter the phone information, however remember that this profile will not be dialing out, it will just be receiving images.
5. Click on “cancel” so that it does not dial.
6. Select Transfer | Receive File, and enter the correct destination for the images “c:\images” or “d:\seemor\images”. When you save this profile, it will remember this information.
7. Type “ATZ” in the hyperterm window and make sure that the modem responds “OK”.
8. Type “AT&F1M0S0=1S7=45S11=50Y0&W0” followed by a return. The modem should respond OK. If it does not, enter the string again. This will program the modem for auto-answer mode. It also will store this setup in non-volatile memory so that even if the modem is turned off, it will still be in auto-answer mode when it is turned back on.
9. Select File | Save to save the modem profile.
10. Select File | Exit to exit hyperterm.
11. Find the new “Receive Images” icon and drag it onto the desktop for the physician.
12. Now test the icon by double clicking on it. Select cancel (because you do not want it to dial). Then press AT and make sure that the modem responds OK. Also make sure that at the bottom of the hyperterm window, it says “**CONNECTED**”.

C. TESTING

To test the blast installation and modem connectivity, run the blast program and try to connect to the remote computer.

1. Login as imaging.
2. `cd /opt/blast`
3. `blast`
4. Select a profile. Press enter to select a desired profile, then use modify to change the phone number for a test facility. If there is a local PC which can be used to receive images, this will work very well since you can see the communication on both ends.

5. Select Online
6. Before dialing, prepare the remote PC by loading hyperterm, and typing AT to make sure that the modem is connected. The modem must also be set up for auto-answer by typing "ATS0=1" in hyperterm if it is not already enabled. See the SeeMor instructions for more information on PC Hyperterm, or Microsoft's instruction booklet, or you may use any PC communications package which supports zmodem. Most communications packages support reliable zmodem transmission.
7. Select Connect. This will dial the remote PC. You will see the modem connect, but you will not get a login like you will with a Sun computer. To test an actually connection, dial a Sun workstation and go through the login process under "Terminal".
8. You can use "Ctrl K" twice to exit from the Terminal mode, and "Ctrl A" to exit from the menus of blast. Once the modem has connected to the PC, you can type "Ctrl K" twice to exit from the terminal mode, and then press "F" for Filetransfer and "S" for Send. Enter a filename to send to the PC for testing purposes.
9. If the file sends correctly, then the blast install process has been completed successfully. If there are any problems, refer to the blast documentation for further assistance.

XXI.LaserCamera (film) Installation

Follow these instructions to install a Cemax LaserLink card on a Rational Imaging workstation.

A. SUNOS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Retrieve the device drivers for SunOS from the cemax partition on the installation tape.

```
cd /home ;  
mt -f /dev/nrst0 fsf 10 ;      (skip to the correct tape partition)  
tar xvf /dev/nrst0 ;  
cd /home/cemax ;
```

Perform the installation per the instructions in the README and installation files under the cemax directory.

Reboot the computer to make this driver active. **WARNING:** Use the instructions provided in the System Maintenance section (page 98) regarding how to shutdown and reboot the UNIX workstation. DO NOT simply power cycle the computer.

B. SOLARIS INSTALLATION

Shutdown the system and install the LaserLink card. Attach the cables to the laser camera with the help of the laser camera's service engineer. Have the service engineer configure the digital board on the laser camera to Cemax's specifications.

Reboot the workstation using "-r" to have the workstation recognize the new hardware.

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging disk, and select the package ISTfilm from the list of packages on the tape as follows:

```
pkgadd -d /jaz/sol2/sparc/pkg ;  
select the number for ISTfilm ;
```

Obtain a license for rifilm and install it on the server.

```
rsh server  
add_license < rifilm_license_file
```

Read the /opt/ISTri/film/README file and make sure that all of the installation steps have been performed. Depending on the Sun OS used, there may be some patches to apply prior to the INSTALL script.

After installing the ISTfilm package, perform the following operations.

```
cd /opt/ISTri/film
./INSTALL          (install drivers)
reboot -r
cd /opt/ISTri/film
mv camcap camcap.old
addcam             (to add a new laser camera)
ln -s /opt/ISTri/film/camcap /opt/ISTri/bin/camcap
ln -s /opt/ISTri/film/filmer /opt/ISTri/bin/filmer
```

After creating the camcap file, edit it and set the following parameters:

```
Edit /opt/ISTri/film/camcap
    DefFormat = "1 on 1"
    MaxHSize = 6000
    MaxVSize = 6000
```

C. CONFIGURATION

Log in to the database server and use risetup to add a new printer called "*XRayFilm*" or "*Kodak*".

```
cd /home/ist/admin;
risetup;
add a new printer;
    name = Kodak          (this name must match the camcap file)
    width = 1400
    height = 1700
    resolution = 150
    directory = /net/cemax_host/img/film
```

Save this configuration, and RView will then print film images to the selected directory. There will be 2 files in the directory for each print page: 1) RImag* is the image file, 2) RIfilm* is the job control file. Once RView prints these images, you can test filmer by typing:

```
/opt/ISTri/bin/filmer -c /opt/ISTri/bin/camcap /img/film/RIfilm###
```

If filmer runs without error, then rifilm will operate correctly. RIfilm is started automatically by "load_riconnect" when the licenses are added to the database server. Since "check_ri_daemons" calls load_riconnect and runs as a cronjob, rifilm will be loaded automatically when the system is licensed. If it is not, check rifilm manually to make sure that there are no errors reported "rifilm /img/film". Also check load_riconnect and make sure that the rifilm loading section is not commented out.

D. KODAK CONFIGURATION

The following configurations were provided by Kodak for their Laser Camera. If problems persist with these settings, try using Odd parity as this has been found to work on some cameras.

1/3/96

CEMAX tech support

BASED ON ERROR MESSAGES: (PROBLEMS.1)

Bill Atkinson from CEMAX provided this configuration.

email bill@cemax.com

800-898-5688

camera port parameters may be wrong

control errors

channel config using KCL config is Q

host protocol type : 1

command port ID# 3

enable aux keypad NO

page prealloc NO

image data param line timer 5

image parity 1 (EVEN) -- 6/10/98 Amir found ODD parity works at Inglewood.

transfer mode 1 (PARTIAL)

sync mode 2

XLP upgraded with NOT FIXED RESOLUTION - VARIABLE

command port config

stop bit 1

parity 0

data length 8

9600 baud

driver type 422

receive frame timeout 30

start timer 2

acq wait timer 180

start timeout counter 65535

acq wait timeout counter 3

max rejects counter 3

Call corporate office to get config for CEMAX modality...

right protocol RS422/449

RS232 is default and is wrong

Timeouts need to be checked...

XLP right... need the following

acknowledge wait timeout 180 seconds

receive frame timeout 30 seconds

MODALITY SETTINGS

E. TESTING

The cemax directory contains test images, test scripts and the filming applications required to send images to Kodak, 3M, or Dupont Laser Cameras. Modify the "camcap" file

according to the instructions, and then use “filmer” to test the camera link with the test images and scripts.

```
cd /opt/ISTri/film
```

```
filmer -c camcap kodak.fjob1
```

Then use RView to print some images to /img/film. Use filmer to see if these print successfully.

```
cd /img/film
```

```
ls
```

```
/opt/ISTri/bin/filmer -c /opt/ISTri/bin/camcap /img/film/RIfilm###
```

Finally, try rifilm to make sure that the images are printed and deleted.

```
/opt/ISTri/bin/rifilm /img/film
```

XXII.Operators Manual Installation

Rational Imaging has a postscript manual which may be installed and viewed on the Rational Imaging workstations.

A. SUNOS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Retrieve the device drivers for SunOS from the apunix partition on the installation tape.

```
cd /home ;  
mt -f /dev/nrst0 fsf 11 ;      (skip to the correct tape partition)  
tar xvf /dev/nrst0 ;
```

B. SOLARIS INSTALLATION

Login as root, since you will need superuser privileges to perform this step of the installation.

Insert the Solaris Rational Imaging tape, and select the package ISTman from the list of packages on the tape as follows:

```
pkgadd -d /dev/rmt/0n ;  
select the number for ISTman ;
```

C. CONFIGURATION

The manuals may be displayed by double-clicking on them from the file manager.

XXIII. Network Architecture

A. CLIENT SERVER RELATIONSHIPS

The Rational Imaging PACS system maintains an enhanced form of client server relationships. Since the login database is used to control access to the various patient databases, this database could be considered a SERVER in the natural sense since each of the workstations depends upon it for information. However, in the Rational Imaging environment there may be many servers. Each workstation that maintains a patient database can be considered a server. Normally, there will be one patient database for an outpatient radiology practice. However, it may be advantageous to have several patient databases, one for each of the departments or facilities involved in a Wide-Area-Network architecture. Since there are advantages and disadvantages to both approaches, consult with our technical representatives during the planning stages of the Rational Imaging installation to determine which scenario would best suit your facility.

B. CENTRALIZED DATABASE

The login database and each of the patient databases can be considered, by themselves, to be centralized, since all of the information contained in the database tables is maintained on their individual workstations. This architecture works fine for the patient demographic information and system information, since it requires very little storage space and minimal effort to distribute the information to inquiring applications.

The result of this architecture is that any workstation on the network can obtain a list of patients, exams, series, images or various archive information. Also, all of the workstations will receive the same updated information as exams are added or removed (archived) from the database tables. This method of maintaining the PACS information optimizes the reliability and ease of operation since the knowledge of where the actual databases, or images, are located, is transparent to the operator.

C. DISTRIBUTED IMAGE DIRECTORIES

A centralized database architecture is not appropriate for the image data however, since the network traffic would be tremendously increased by images always coming from ONE workstation (the server). What makes the images different from the demographic exam information, THEIR SIZE!. Each exam should be maintained on the workstation where the images will be reviewed. In a multi-facility scenario, it would be inefficient and unthinkable to locate all of the images on one workstation, since each time you wanted to review the case, it would have to come across the network to your workstation. This would not only tie up the network, it would also overwhelm the database server resulting in very poor performance. An alternative to this approach is to locate the images in the

facility where they were acquired or where the images will eventually be read. Therefore, the images only need to traverse the network twice, once during import into the PACS system (onto the RI workstation), and once during archiving and auto-removal (usually during the night to minimize daytime network traffic).

This distributed approach to image storage is efficient and versatile, since anyone can access the images no matter what workstation they are at. If a second opinion is required, a physician at the other facility could simply select the patient and the images would be retrieved across the network for their review. The physician will only notice a slight delay since the images are coming across the network and not from their local disk drive. These simplistic database techniques provide intuitive access to any exams within the imaging system, while maintaining performance of the mission-critical components of the network.

D. NETWORK DEPENDENCY AND RELIABILITY

Due to the centralized and distributed components of the PACS system, there is a high dependence on network and workstation reliability. If the network were to go down between a remote workstation and the database server, then access to the remote workstation's images would be impossible even though the images may reside on the remote disk drive. Since the remote workstation would not be able to communicate with the database server (obtain a list of patients), it would not be able to find out where those images were located.

1. Server Crash

This dependence requires careful planning to minimize the chance of occurrence. If the network server were to go down, obviously it has catastrophic repercussions. How do you rebuild the database and what happens to the archive information on ALL YOUR TAPES???

Don't panic yet, each time you initialize a new archive tape, the current login, patient and archive databases are backed up at the beginning of that tape. While this does take some of the tape space (approx 10-20MBytes), it is an inexpensive insurance policy (5-10cents/tape) to have in the event of a hard disk crash corrupting the database tables. The databases can thus be rebuilt once the workstation has been repaired, or it can be transferred to another workstation making that system the database server.

2. Add-on Workstation Crash

Even if an add-on workstation were to crash, all of the exams on that system may be lost. Using proper protocols for patient archival is one way to minimize the loss of image data. Archive the exams on the primary tape as soon as possible. Do not remove the exams from the scanner until they exist on tape. Use duplicate backup tapes to protect against theft, fire, or improper tape handling. Archive one of the tape sets at another facility or take it off-site as soon as possible. These protocols should be followed with great diligence in order to protect your data.

3. Network Crash

If the network were to go down, then communication to the scanners, to the database server, and between the other workstations would be limited. The ability of the Rational Imaging system to recover from this event depends upon the length of time and the nature of the network problems.

Since each of the workstations depend upon the database server for exam information, if the connection to the server were to go down, all of the workstations would be affected. If, however, only one add-on workstation were to be isolated from the network, then that workstation would be inoperable and all of the images on that workstation's disk would be inaccessible. Notify the other system users to avoid trying to access the images on that workstation since errors will result.

To avoid network problems, use duplicity wherever possible. If you are connecting three facilities (A, B, and C) with T1 lines between A and B, and A and C, then add an additional low speed line (maybe ISDN) between B and C in the event that one of the T1 lines goes down. This will allow the network to function during the repair even though the performance will be slightly decreased. You may also purchase a third T1 line between B and C, however the cost of doing so for insurance purposes may be prohibitive compared to ISDN.

XXIV.Administrative Tasks

A. SYSTEM DIAGNOSTICS

To list the current Rational Imaging version applied to the workstation, enter the following command:

```
more /opt/ISTri/bin/riVERSION;
```

We have included a diagnostic utility to print the current machine status to the Paper Film Imager. Please run this program and include its output with your letter. To operate the program enter the following command at the UNIX console:

```
/opt/ISTri/bin/richeck;
```

RIcheck reports the following system parameters:

- current date
- username
- hostname
- hostid
- **RI** programs and version numbers
- disk partitions and usage
- memory diagnostics
- environment variables

An example output file is shown below (**richeck.dat**):

----- Rational Imaging - Diagnostic Utility v1.1

```
Fri May 20 14:35:23 PDT 1994
imaging console May 19 06:13
tech ttya May 20 14:35
Hostname: RI_host
Host ID: 12345abc
```

PROGRAM VERSIONS-----

```
remove Version 3.23e
riport Version 3.9E
ristore Version 2.26W
rview Version 1.98U
ridesign Version 1.0P
rilogin Version 1.0L
riconnect Version 1.0H
```

DISK DIAGNOSTICS-----

Filesystem	kbytes	used	avail	capacity	Mounted on
/dev/sd3a	10911	4135	5685	42%	/
/dev/sd3g	286255	194813	62817	76%	/usr
/dev/sd0a	189858	87830	83043	51%	/home
/dev/sd3h	893574	502041	302176	62%	/images

MEMORY DIAGNOSTICS-----

```
PID TT STAT TIME COMMAND
```

```

0 ? D 0:15 swapper
1 ? IW 0:00 /sbin/init -
2 ? D 0:22 pagedaemon
55 ? S 1:37 portmap
60 ? IW 0:00 keyser
69 ? I 0:10 in.routed
75 ? I 0:12 (biod)
86 ? IW 0:00 syslogd
94 ? IW 0:00 /usr/lib/sendmail -bd -q1h
106 ? I 1:19 (nfsd)
107 ? I 1:18 (nfsd)
108 ? IW 0:00 rpc.mountd -n
111 ? IW 0:00 rpc.statd
112 ? IW 0:00 rpc.lockd
118 ? IW 0:00 /usr/local/bin/rpc.pcnfsd /usr/tmp
120 ? S 1:40 /home/informix/lib/sqlxecd
130 ? S 0:08 /usr/bin/screenblank -d 300
136 ? S 13:26 update
139 ? IW 0:00 cron
145 ? IW 0:00 inetd
149 ? IW 0:00 /usr/lib/lpd
166 ? IW 0:00 /RI_host/home/ist/bin/riconnect
338 ? IW 0:00 rpc.rquotad
2085 co IW 0:00 -csh (csh)
2139 co IW 0:00 /bin/sh /usr/openwin/bin/openwin -noauth
2141 co IW 0:00 /usr/openwin/bin/xinit -- /usr/openwin/bin/xnews :0
2142 co S 19:15 /usr/openwin/bin/xnews :0
2149 co IW 0:00 sh /usr/openwin/lib/Xinitrc
2157 co IW 0:00 sv_xv_sel_svc
2158 co IW 0:00 vkbd -nopopup
2159 co IW 0:00 dsdm
2163 co IW 0:25 olwm -syncpid 2162
2164 co IW 0:00 olwmslave
2171 co IW 0:23 /RI_host/home/ist/bin/rilogin
2175 co IW 0:32 /home/informix/lib/sqlxecd imaging 5.00.UC2
2720 co IW 0:07 /RI_host/home/ist/bin/riview
4290 co S 0:41 /RI_host/home/ist/bin/riport
4291 co S 2:57 /home/informix/lib/sqlxecd imaging 5.00.UC2
4292 a IW 0:00 -csh (csh)
4300 a S 0:00 /bin/sh richeck
4319 a R 0:00 ps -ax
2170 p0 IW 0:00 cmdtool -Wp 0 566 -Ws 896 233 -WP 3 833 -Wi -C
2172 p0 IW 0:00 -bin/csh (csh)

```

SWAP DIAGNOSTICS-----

```

313/582 files
296/352 inodes
57/138 processes
43372/66636 swap

```

ENVIRONMENT VARIABLES-----

```

DBPATH=/RI_host/home/ist
HOME=/home/tech
INFORMIXDIR=/home/informix
LOGNAME=tech
OPENWINHOME=/usr/openwin
PATH=./home/tech:/usr/openwin/bin/xview:/usr/openwin/bin:/usr/bin:/usr/ucb:/etc:
/usr/etc:/RI_host/home/ist/bin:/home/informix/bin
PWD=/RI_host/home/ist/bin
RILOGDB=/RI_host/home/ist/rilogin
RIPROGDIR=/RI_host/home/ist/bin
SHELL=/bin/csh
SQLEXEC=/home/informix/lib/sqlxecd
USER=tech

```

DIAGNOSIS COMPLETE-----

B. ACCESSING/CHANGING DATABASE CONFIGURATION INFORMATION

This section will describe the script files which have been created for your convenience to add, list or modify the various database system parameters. These scripts are driven by a major menu system called “**risetup**”.

These files are located in the “/home/ist/admin” (/opt/ISTri/admin for Solaris) directory. Change to this directory **on the database server**, run risetup, and select the desired command from the menu:

```
cd /home/ist/admin      (Solaris 1)
cd /opt/ISTri/admin     (Solaris 2)
risetup
```

1. Change current database

This function will change the patient database selected. The following operations may be performed on the selected patient database.

2. Create user account

This function will create user accounts in UNIX. It will copy the “imaging” account setup into a new home directory. Operate this function as “root”.

3. Add user to rilogin

This script will add new user information into the rilogin table.

4. Add user to patient database

Add a new user to each patient database.

5. Add database access to rilogin

This script will notify the login database “rilogin”, that multiple databases exist. It will allow the operator to enter new databases for restricted or unrestricted access. This script will also designate user access for restricted databases.

6. Add host to patient database

This script will add a new Rational Imaging Workstation or scanner to the patient database.

7. Add image directory to patient database

This function will configure a new disk directory as an active image directory. Make sure that this directory is unique among all the databases that have access to this host (ie: The cardiology and radiology databases can not both have the image dir /net/host/img. Make the directories specific to the database such as /net/host/img/cardiol and /net/host/img/radiol).

8. Add printer to patient database

This script will allow all users to access Canon PaperFilm Printers on the network.

9. Add tape drive to patient database

Add a tape drive for archive/retrieve purposes to a Rational Imaging workstation.

10. Add archive tape set to patient database

Initialize a new archive tape set in a selected patient database. This will allow the storage of exams on specific tape sets for research or personal needs.

11. List users in rilogin and the selected patient database

List the configuration parameters for each user in the login database and the selected patient database.

12. List database access in rilogin

List the available databases and the restricted access parameters

13. List hosts in patient database

List all available hosts and the configuration parameters in the selected database

14. List image directories in patient database

List all of the image partitions configured for the Rational Imaging workstations.

15. List printers in selected patient database

List the available Canon PaperFilm printers

16. List tape drives in patient database

List the tape drives which will be available for archival/retrieval by RIstore.

17. List archive tape sets in patient database

List all the tape sets available to RIstore which have been created in the selected patient database.

18. Edit users in rilogin

Modify the configuration parameters for a selected user in the login database.

19. Edit user in patient database

Modify the parameters for a user in the selected patient database.

20. Edit database access in rilogin

Change the database access and restrict or unrestrict a selected database.

21. Edit host in patient database

Modify the host information in the selected patient database.

22. Edit image directory in patient database

Change the name or alias of an image directory configured for the Rational Imaging workstations.

23. Edit printer in patient database

Modify the printer information in the selected database.

24. Edit tape drive in patient database

Change the parameters of the tape drives configured for archival / retrieval.

25. Edit archive tape set in patient database

Modify the parameters of selected tape set in a patient database.

26. Delete user in rilogin

Delete a user from rilogin. This will restrict the use of the Rational Imaging system for former employees. DO NOT delete a user from the patient database since many operational workflow flags have been linked to their user accounts. You can remove the user accounts from the UNIX workstations however.

27. Delete database access in login database

Delete access to a particular database for all or individual users

28. Delete host in patient database

Delete a non-functional host from the patient database. MAKE SURE that there are no exams on the host before it is deleted.

29. Delete image directory in selected patient database

Remove an image directory from a specified host. MAKE SURE that there are not exams on the image partition before it is deleted.

30. Delete printer from patient database

Delete a printer which no longer needs to be accessed from the selected patient database

31. Delete tape drive from the patient database

Delete a selected tape drive from the patient database.

32. Delete archive tape set in patient database

Delete an archive tape set from the selected patient database. Make sure that there were no exams on the tape set, or that the exams no longer need to be retrieved or logged.

33. List all tables in the patient database

This function will list all the current tables in the selected patient database. Use this function to get the most current details on the architecture and fields of the patient database tables.

34. List all tables in rilogin

List all of the tables and their related fields in the login database. This will present the most current architecture of this database structure.

35. Activate/Deactivate a host in the patient database

Use this function to designate a host as “inactive” during maintenance. This will notify all programs/users that the exams and functions of the workstation will be inactive during this period. Use this function to reactivate the host.

36. Clear use flags in the patient database

When the use flags have become contaminated because of hardware problems, use this function to clear all of the exams and show them as “not in use”.

37. Add a Jukebox to the patient database

Use this function to add a new jukebox to a selected Rational Imaging workstation.

38. Associate a tape drive with a Jukebox in the patient database

First, define a new tape drive for a given host, then use this function to associate that tape drive with a previously defined Jukebox. Some Jukeboxes contain up to 6 drives.

39. Add available slots to a Jukebox in the patient database

During the initial Jukebox configuration, this function must be run to define the number of available slots within the Jukebox. DO NOT define more slots than physically available on the Jukebox.

40. List Jukebox in patient database

Use this function to list all of the defined Jukeboxes

41. Delete Jukebox in patient database

Delete a selected jukebox from the selected patient database

42. Add Monitor to patient database

Use this function to configure the monitors in an initial installation. Use the defaults unless you have determined the actual black levels and gamma using the ricalibrate function.

43. List Monitor in patient database

List the defined monitors and their parameters in the selected patient database

44. Edit Monitor in patient database

Edit the configuration parameters of a selected monitor

45. Delete Monitor in patient database

Delete a selected monitor in the patient database.

46. Add modem in patient database

Specify the operational parameters of a modem attached to a Rational Imaging workstation.

47. List modem in patient database

List the parameters of the available modems.

48. Edit modem in patient database.

Edit the operational parameters of a selected modem.

49. Delete modem in patient database

Delete a selected modem from the patient database

50. Unlock expired exam in patient database

Manually unlock all the exams where the lockdate aging has expired. This function will be automatically accomplished nightly on the server using a cron job under imaging.

51. Associate a tapeset with a Jukebox drive in Radiology

Select the tapesets which will be supported on a particular jukebox. The primary and secondary tapesets should be archived on different drives.

52. Edit tapeset support for a Jukebox in radiology

Edit the tapesets associated with a selected jukebox.

53. List jukebox support for tapesets in radiology

List the tapesets which are supported on a selected jukebox.

54. Delete jukebox tapeset support in radiology

Delete the tapesets which are supported on a selected jukebox.

C. PERFORM SYSTEM BACKUP

The best way to ensure reliability and prevent against hardware malfunctions is to keep a current backup of each workstation. This can be done easily using the tape drives provided for archival. **BE CAREFUL not to use a tape for backup which has been labeled as a patient archive tape.**

Insert a BLANK TAPE into the appropriate tape drive and use the following instructions to backup the workstation's disk partitions. Perform this operation as superuser and while the workstation is not being used (in the evening if possible). The SUN manuals recommend operating in the single-user environment for a complete backup, however this will stop the access to any exams on the workstation during the backup. This may therefore, not be possible.

1. Local backup on a system with a tape drive attached.

To perform backup of the system portions of your current workstation, first determine the current disk configuration and partition information by entering the following command at the UNIX prompt:

```
df;
```

This program will list all of the disk partitions (beginning with "/dev") and the NFS mounted partitions (beginning with a hostname).

Use the following command to archive the disk partition "/dev/rsd3a" to the tape. You must use the "raw" disk device. For example if "df" lists "/dev/sd0g" as a disk partition, then archive it by specifying "/dev/rsd0g" as the device. (This command is valid for the **SunOS version 4.1.3**, if another version is being used, verify the parameters using the Administrator's manual provided by SUN).

```
dump 0dsbfu 54000 6000 126 /dev/nrcht0 /dev/rsd3a;
```

Repeat the previous command for each of the disk partitions and then rewind the tape using the following commands:

```
mt -f /dev/nrcht0 rew;
```

```
mt -f /dev/nrcht0 off;
```

Label the tape appropriately, turn on the write-protect feature, and store in a safe place.

2. Backup of a remote system with no tape drive.

Log into the workstation with the tape drive and perform the archival of the remote workstation from here.

First obtain the disk configuration of the remote workstation by logging into it and running the "df" command.

```
rsh hostname ;  
df ;  
exit ;
```

This program will list all of the disk partitions (beginning with "/dev") and the NFS mounted partitions (beginning with a hostname).

When you have returned to the local workstation using "exit", use the following command to archive the disk partition "/dev/rsd3a" to the tape. You must use the "raw" disk device. For example if "df" lists "/dev/sd0g" as a disk partition, then archive it by specifying "/dev/rsd0g" as the device. (This command is valid only if both the workstations are operating under **SunOS version 4.1.3**. If another version is being used, verify the parameters using the Administrator's manual provided by SUN). Replace **thost** with the name of the current host with the tape drive attached, and replace **rhost** with the name of the remote host. This command is shown on two lines due to limited space, however it should only be typed on one line.

```
rsh rhost rdump 0dsbfu 54000 6000 126 thost:/dev/nrcht0 /dev/rsd3a ;
```

Repeat the previous command for each of the disk partitions and then rewind the tape using the following commands:

```
mt -f /dev/nrcht0 rew ;  
mt -f /dev/nrcht0 off ;
```

Label the tape appropriately, turn on the write-protect feature, and store in a safe place.

XXV.Change Server Host

A. SUMMARY

If the server was installed as a system that becomes used heavily, it may be necessary to move the server host to another machine that is less active. Try to choose a system that is not used for image review (or at least only light review) so that memory limitations do not cause problems. Also, try not choose a system which is serving images, as the disk access for the database will be restricted. Optimally, a dedicated server is best to improve memory and disk access for the database. Remember, the database tries to retain its indexes in RAM, so if other applications are constantly moving the database info into swap space, then the efficiency of the server will be cut dramatically.

B. PROCEDURE

- 1) Schedule at least 1 hour to perform the conversion.
- 2) Make sure that no images are being transferred to the workstations.
- 3) Kill all "ri*" and "sql*" processes on the server


```
su
/opt/ISTri/bin/slay ri
/opt/ISTri/bin/slay sql
```
- 4) Backup the radiology and rilogin databases.


```
cd /db
tar cpf /img/dbBackup.tar *.dbs
```
- 5) Rename the radiology database


```
mv radiology.dbs radiology.old
mv rilogin.dbs rilogin.old
```
- 6) Log in to the new server
- 7) Rename the new server's informix directory


```
cd /opt
mv informix infold
```
- 8) Make a new informix directory on the new server


```
mkdir /opt/informix
chown informix /opt/informix
chgrp imaging /opt/informix
```
- 9) Install SQL, SE, INET informix applications from CD into "/opt/informix"
- 10) License SQL


```
cd /opt/informix
./installsql
```

- 11) License SE


```
cd /opt/informix
./installse
```
- 12) License INET


```
cd /opt/informix
./installnet
```
- 13) Copy the databases to the new server


```
cd /db
tar xpf /net/oldservername/img/dbBackup.tar
```
- 14) If a different version of Informix was loaded on the server, you will need to perform the following commands. Delete the radiology.old once the database has been tested. Perform these steps as "imaging".


```
cd /db
mkdir /img/db
dbexport -o /img/db /db/radiology
mv radiology.dbs radiology.old
dbimport -i /img/db radiology
dbaccess radiology - <<EOF
update statistics;
EOF
```
- 15) Modify each user's ".cshrc" file to point RILOGDB to the correct server
- 16) Modify each user's ".select_db" to specify correct servers
- 17) Perform the last 2 steps on ALL workstations for ALL users
- 18) Copy /etc/init.d/ri.install on old server to the new server
- 19) Comment out the line which loads sqlxecd in "ri.install" on the **OLD** server. Make sure that you comment the "if" and "fi" statements also.


```
#if [ -f /opt/informix/lib/sqlxecd ]; then
# /opt/informix/lib/sqlxecd &
#fi
```
- 20) Modify redundant on new server (change redundant host)
- 21) Add redundant to imaging's crontab on new server
- 22) Remove redundant from imaging's crontab on old server
- 23) Modify backup_radiology on new server (change redundant host)
- 24) copy redundant and backup_radiology to ALL hosts /opt/ISTri/bin


```
cd /opt/ISTri/bin
rcp redundant hostname:/opt/ISTri/bin
rcp backup_radiology hostname:/opt/ISTri/bin
```
- 25) Modify auto_archive.dat data files to point to correct database location
- 26) Modify reset_modems to point to correct database location
- 27) Copy reset_modems to ALL workstations


```
cd /opt/ISTri/bin
rcp reset_modems hostname:/opt/ISTri/bin
```
- 28) Use risetup to edit the database directory "'//newhost/db" (Option 20).
- 29) Modify the /etc/hosts.equiv to add all RI workstations on the server

- 30) Modify the `./rhosts` to add all RI workstations on the server
- 31) Remove server cronjobs from the Old server (`expire_locks`, `ridundant`)
 - `su`
 - `ssh`
 - `setenv EDITOR vi`
 - `crontab -e` (`"dd"` to delete unwanted lines, `":wq"` to save/quit)
- 32) Add server cronjobs to the New server (`expire_locks`, `ridundant`)
 - `crontab -e` (`"i"` to insert lines, `"esc"` to stop insert, `":wq"`)
- 33) Reboot all systems
- 34) Test all systems (RIview should be able to display images)
- 35) Test `ridundant` and `backup_radiology`
- 36) Test archiving
- 37) Resume operations

XXVI. System Maintenance

A. SHUTDOWN DATABASE SERVER

1. Preparation for system shutdown

In order to move the system or perform system maintenance, it may become necessary to shutdown the system. If you are shutting down the **database server** containing Informix SE and the database files, no one will be able to use the *RI* system during the down time. If maintenance is to be prolonged, use the following procedure:

- Install the Informix SE and ESQL-C on another workstation (Redundant Server).
- Notify the other users not to use *RI* until further notice.
- Archive and remove all of the exams on the *RI* system.
- Copy the *RI* database files to the other workstation. **Make sure that no users or programs are using the database files during this transfer.**
- Change each user's environment variable **RILOGDB** to the new workstation's database directory `"/new_workstation_name/db/rilogin"`.
- Notify the other users that they may resume operation of the *RI* system. Remind them not to use any image disks associated with the system being repaired.
- Perform the instructions in the next few sections on shutting down the workstation.

Always archive all of the patients on the *RI* system before halting the database server. This will minimize the loss of data should a disk malfunction occur during system startup. Coordinate this effort with our technical support staff to prevent loss of data.

2. Shutdown Instructions

Use the following commands to perform system shutdown. **DO NOT DEVIATE FROM THESE INSTRUCTIONS OR HARD DISK ERRORS MAY RESULT!**

- Logout if you are currently logged in as an *RI* user.
- Log in as *root* and give the correct password. If you do not know the password, contact technical support.
- Type: **sync<enter>** to synchronize the disk and remove from memory any unwritten disk information.

- Type: **shutdown -h now (shutdown -y -g0 -i0 [Solaris])** to shut down the system immediately. This will notify other workstations with beeps combined with a notice appearing in their main console that shutdown is eminent.

B. SHUTDOWN ADD-ON WORKSTATION

1. Preparation for system shutdown

In order to move a system or perform system maintenance, it may become necessary to shutdown the workstation. If you are shutting down the **client workstation (not the database server)** then the procedure is less complicated:

- Notify the other users that the workstation will be down and that the exams on that workstation will be inaccessible. Remind them not to use any image disks associated with the system being repaired.
- Use RIport to determine the exams located on this workstation. Sort the exams by "*location*". Archive and remove all of the exams on the *RI* system if possible. Or you can use Riport to move the exams to another workstation. If the workstation is only going to be down for a few moments, then this step may be skipped.
- If the system will be down for a long time or is being removed from the Rational Imaging system, then delete this workstation from the database tables "host" in the rilogin database. Also delete the image directories attached to this system. This will prevent access while the system is being repaired.
- Use "set_active" in the /home/ist/admin directory to set the workstation as inactive (0). This will notify the other workstations that the system is out of commission for a while.
- Complete the system shutdown as described in the following section.
- Notify the other users that they may resume operation of the RI system.
- Perform the instructions in the next few sections on shutting down the workstation.

2. Shutdown Instruction

Use the following commands to perform system shutdown. **DO NOT DEVIATE FROM THESE INSTRUCTIONS OR HARD DISK ERRORS MAY RESULT!**

- Logout if you are currently logged in as an *RI* user.
- Log in as *root* and give the correct password. If you do not know the password, contact technical support.
- Type: **sync<enter>** to synchronize the disk and remove from memory any unwritten disk information.
- Type: **shutdown -h now** to shut down the system immediately. This will notify other workstations with beeps combined with a notice appearing in their main console that shutdown is eminent.

3. Reboot Instruction

The workstation will automatically be rebooted when the power is restored to the workstation. However if you do not cycle the power, then you may also enter "boot" at the

"OK" prompt, or "b" at the ">" prompt to restart the system. Refer to SUN's administrator guide for additional information regarding boot procedures.

4. Halt in the event of system lockup

On occasion it becomes necessary to HALT the system when it becomes locked up. **USE THIS ONLY AS A LAST RESORT.** Since this procedure does not synchronize the disks properly, it is only suggested in the event that the system will respond to any other commands. First try to wait for 10-15 minutes to see if the system will resume normally (sometimes it gets confused and takes time to reset and continue operation). Then try to kill off the programs which may be locking up the system by logging in from a remote workstation. Contact technical support for information regarding these procedures.

Finally, when all else fails, use the following keystrokes to halt the system <STOP>A. Press A while the STOP function key, or L1 on some keyboards, is being depressed. following commands to perform system shutdown. Reboot the system by typing **"reboot;"**

5. Reset the workstation as 'ACTIVE'

Use the "risetup" script in the /home/ist/admin directory to set the workstation as active(1). Select the active menu option from the displayed menu.

cd /home/ist/admin (Solaris 1)

cd /opt/ISTri/admin (Solaris 2)

./risetup

Make sure that the system responds properly and if it does not, contact our technical support hotline.

XXVII.Database Errors

A. OVERVIEW

If the unix workstation is terminated improperly, due to a power outage or other failure, the database tables may become corrupted. The degree of corruption will determine whether the database should be reloaded from the redundant server. If only the indexing has been effected and the actual data is intact, refer to this section. If the following suggestions fail to resolve the database errors, refer to the next section on rebuilding the database.

B. PREVENTING USE OF THE DATABASE DURING ANALYSIS AND MAINTENANCE

Stop all archiving, image transfer and other database activities. Then log into the database server, reboot the server, and then change to the database partition and rename the database. You may wish to warn others that the PACS system will be down, however it probably already is down if you are performing these procedures.

```
reboot
ps -ef | grep sqlexecd      list PID of process sqlexecd
kill -9 PID                 kill process using PID
/opt/ISTri/bin/slay sql      kill all sql processes
cd /db
mv radiology.dbs radold.dbs
```

To backup the database in the event of mistakes, use the following procedure. It is probably wise to also backup the redundant server at this time as this is a critical resource.

```
cd /db
tar cvpf /img/radiology.tar *.dbs
```

This will copy all of the database files into the radiology.tar file.

C. DETERMINING THE DATABASE ERRORS

Use “bcheck” to determine if any database errors are present.

Log into the database server as “imaging”, and change to the database partition:

```
cd /db/radold.dbs
```

Run bcheck, an informix utility, to test the integrity of the files:

```
bcheck *
bcheck imag*           (example to check only image tables)
```

If any errors are present, answer “Y” to deleting an index and remaking it. After completion of this program, run it again to make sure that the problems have been fixed. If

successive operations do not reconstruct the indexes, then their may be faulty data, or duplicate keys to prevent indexes from being created.

D. REMOVING DUPLICATE KEYS

If the indexing problems result from duplicate keys in a file, then the bcheck program will show the records that are in error. You can use dbaccess to remove these records from the database and then run bcheck again to rebuild the indexes.

```
cd /opt/ISTri/diag  
DropIndexes /db/radold
```

Run the DelDupIndexes script to delete duplicate indexes from the contaminated database.

```
dbaccess /db/radold DelDupIndexes
```

Once these duplicate records are deleted, then the indexing should be corrected with bcheck as described in the previous section. You will first need to reindex the file using CreateIndexes. If there are any errors indexing the files, then there are most likely some duplicate indexes still. Use the errors to identify them and ListDupIndexes to verify their existence.

```
CreateIndexes /db/radold  
cd /db/radold.dbs  
bcheck *
```

If the CreateIndexes *reports errors*, then use check_integrity to remove any unlinked exams.

```
/opt/ISTri/bin/check_integrity /db/radold fix  
DropIndexes /db/radold  
CreateIndexes /db/radold
```

If problems persist, it may be necessary to export and re-import the database to flush out any problems.

```
cd /db  
mkdir /img/db  
dbexport -o /img/db radold  
mv radold.dbs radold.old  
dbimport -i /img/db radold  
dbaccess radold - <<EOF  
update statistics;  
EOF
```

If this resolves the problems, then remove the “radold.old” directory and its contents.

```
cd /db  
rm -rf /db/radold.old  
rm -rf /img/db/*.exp
```

If the CreateIndexes *reports NO errors*, and *bcheck runs clean*, then rename the database to radiology and reboot the system. DO NOT rename the database until the indexes have been applied, or “riupdate” may try to load images and will add more non-unique keys.

```
cd /db  
mv radold.dbs radiology.dbs  
chown -R imaging *.dbs
```

```
chgrp -R imaging *.dbs
chmod -R a+rw *.dbs
chmod a+rwX *.dbs
reboot
```

E. MISSING DATA POINTERS

In the event that some of the data rows have become corrupted, it may be necessary to rebuild the database from the redundant copy. However, if only a few rows are affecting the indexes, then these can be removed successfully and the database regenerated. In order to do this, you will need to export all of the data into a set of datafiles, import the data into a new database, delete any duplicate entries or corrupt data, and then reindex the database. Use the following sections, and the informix technical manuals, to achieve this goal. It will probably be best to remove all the indexes first, then export and import the database, then recreate all the indexes.

F. EXPORTING THE DATA IN A DATABASE

Informix provides a utility called “dbexport” which allows a user to export the database structure and record data into a set of files. To perform this task, use the following command:

```
mkdir /img/db
cd /db
dbexport radold -o /img/db
```

This creates a directory called /img/db/radiology.exp which contains *.unl files with the data and a radiologyold.sql file which contains the dbschema for the database.

G. IMPORTING THE DATA AND CREATING A NEW DATABASE

Informix provides a utility called “*dbimport*” which allows a user to import the database structure and record data into a new database. Prior to performing the dbimport, you should edit the file **/img/db/radold.exp/radold.sql** to make sure that the owner of each table and procedure is “imaging” and not “root”. Change all values of “root” to “imaging”. To create a new database, use the following command:

```
cd /img/db
dbimport radold -i /img/db
```

This creates a directory called /img/db/radold.dbs which contains the new database and the data from the data files.

If any errors occur which stop dbimport, you probably need to remove all the indexes using “DropIndexes”. Then do the dbexport, dbimport and CreateIndexes.

```
cd /img/db
/opt/ISTri/diag/DropIndexes /db/radold
dbexport -o /img/db /db/radold
cd /db
mv radold.dbs radold.old
dbimport -I /img/db radold
/opt/ISTri/diag/CreateIndexes /db/radold
```

```
dbaccess radold - <<EOF
update statistics;
EOF
```

```
cd radold.dbs
bcheck *
```

Run the previously described tests on the new database to ensure the integrity of the database. If the database evaluation runs successfully and without error, allow users to begin using the database again. Remember to rename the database to allow all users to access it. Also make sure that the permissions are set correctly.

```
mv radold.dbs radiology.dbs
chmod -R a+rw /db/ radiology.dbs
```

H. OPTIMIZING DATABASE QUERIES

When a database is exported, and then imported, the table statistics may be lost. When this occurs the query time increases. To resolve this, enter dbaccess and run the “update statistics” command. The following commands will also perform this from the commandline.

```
dbaccess radold - <<EOF
update statistics;
EOF
```

I. EXAMPLE PROCEDURE FOR MISSING DATABASE LINKS

Relational databases, such as our patient database, rely on primary and foreign keys to relate information in separate tables. For example, a patient may have multiple exams, so the exam table is related to the patient table by the “pat_key”. In the **patient** table, the pat_key field is called the **primary key**. In the **exam** table, the “exam_key” is the primary key, and the pat_key is a **foreign key** relating the exam to a patient. Without this link, we would not be able to determine patient information for an exam. If both exam and patient information were put in one table, the table would not be flexible enough to allow multiple exams. Therefore, our entire database is dependent upon these links.

It is very important that we do not delete related records when there is a foreign key pointing at that data. For example, the exam contains a pointer to the imagedir table so that we will be able to locate the exam on a particular system and disk. This foreign key is called “dir_key”. If the record that dir_key points to from exam were deleted from imagedir, then we could no longer find the exam on a disk. The exam would be rendered invalid in a relational sense.

The upgrade ver_3.2.3 applies foreign and primary key integrity checks to prevent this from occurring in the future, but always use caution when deleting items from the database using risetup or dbaccess.

The following is an example which occurred during an on-site demonstration. I have itemized the procedure we used to diagnose and fix the problem in an attempt to illustrate

the resolution of database problems. Each database problem is slightly different however, and this should only be used as an example.

To diagnose this problem, I proceeded as follows:

- 1) run bcheck on the databases and look for errors

```
cd /db/radiology.dbs
bcheck *
cd /db/rilogin.dbs
bcheck *
```

- 2) check database permissions

```
ls -l /db/radiology.dbs /db/rilogin.dbs | more
chmod -R a+rw /db/radiology.dbs /db/rilogin.dbs
```

- 3) check databases and users links to databases in rilogin (current_db should point to an active database)

```
dbaccess rilogin
select * from databases;
select * from users;
```

- 4) Check partition space (especially img and root)

```
df -ak
```

- 5) Check print jobs and scanned images and remove

```
ls /img/scan
ls /img/print/tmp/printername
```

- 6) Check the database integrity (All images are linked to series, all series are linked to exams, all exams are linked to patients)

```
cd /opt/ISTri/diag
check_db_integrity
```

- 7) Since the symptoms were in loading exams, I suspected that the examlist may have been incorrect. So I deleted the examlist and tried to rebuild it.

```
dbaccess radiology
delete from examlist; (NOT FROM exam)
execute procedure all_exmlst(0); (REBUILD EXAMLIST)
```

ERRORS occurred (Can not insert NULL into examtext). This suggests that one of the exam links to other tables is bad.

- 8) Run a script to identify some bad exams

```
cd /opt/ISTri/diag
check_upgrade
```

if this is not here, then this script is a tool on the jaz disk. I have included a copy for you to keep. This is a new script which will be put on upgraded systems in the future. It was used during the upgrade to version 3.2.0, however I will probably rename the script chk_exmlst

- 9) List the exam info for a bad exam (Number 2 was bad at Sinai for example)

```
dbaccess radiology
select * from exam;
```

```
exam_key      2
pat_key       2          (patient - EXISTS)
exam_no       99999
n_series      1
desc_key      1          (exm_desc - EXISTS)
exam_date     08/05/1985
hosp_key      27         (hospital - EXISTS)
host_key      1          (host - EXISTS)
dir_key       1          (imagedir)
```

```

use_host      31      (host - EXISTS)
use_user      4      (users - EXISTS)
use_program   10
modality      1
archive_uk    0
print_uk      0      (users - 0 OK)
dictate_uk    0      (users - 0 OK)
review_uk     0      (users - 0 OK)
lock_uk       2      (users - EXISTS)
prepare_uk    3      (users - EXISTS)
transfer      0
refer_key     1      (referring - EXISTS)
history       CAMERA
exam_time     10:15:05
import_date   07/10/1997
import_time   17:51:17
age           24
age_mod
lockdate      01/01/1900

```

- 10) Then look for links that do not exist by listing the other associated tables. I have put the table in paren which the key points to.

```

select * from users
  1 riconnec riconnect
  2 imaging Imaging
  3 simms Ed Simms
  4 amador Rich Amador
  5 telerad tele

select * from imagedir
  dir_key  4
  host_key 31
  dirname  /net/aopdemo1/img
  alias    aopdemo1#1

  dir_key  3
  host_key 9
  dirname  /net/aopdemo2/img/data
  alias    Demo2

```

Notice that dir_key of 1 from the exam does not exist in the imagedir table. This is causing the problem. Check to make sure that these exams do exist under /img (or /img2,/img3... or on another system) and assign the correct dir_key to the exams

- 11) Update the exams in error
update exam set dir_key=4 where dir_key=1

- 12) Rebuild the patient list
delete * from examlist;
execute procedure all_exmlst(0);

If there are errors, repeat steps from step #8.

- 13) Set exams so that no exam is in-use (this is probably the case). This does not need to be done except in this case where the case was marked in-use and then RView bombed because it could not locate the patient.

update exam set (use_host,use_user,use_program)=(0,0,0);

- 14) Make sure that the problems have disappeared.

It turned out that 25 of the exams had pointers (dir_key) to a directory which did not exist. The way this occurs, is if someone goes into risetup and deletes an image directory. Then

all the exams pointing to this directory are invalid. This causes problems with creating the patient list among other things.

WORD OF CAUTION: Be VERY careful when deleting items in the database, if there are links to that item it causes major problems.

J. DETERMINING THE DATABASE VERSION

Use “dbaccess -v” on the server to determine the current database version.

XXVIII.Rebuild Server - Emergency

A. OVERVIEW

In the event of a system failure or hard disk crash, it may be necessary to rebuild the archive database and its associated structure. If the database is still accessible, and only some of the tables are corrupted or are symptomatic of indexing errors, refer to the previous section. If you proceed with this section, we will assume that the disk directories have been completely destroyed and therefore a complete installation will be required. To prepare a new system disk and reload the Rational Imaging system, start with section B. To load the current database onto a redundant server which has all the Informix database applications (SE, SQL, INET), start with section C. Some combination of the two may be used to quickly set up a redundant server with the informix applications, and then restore the database files from the archive tapes using section C. The redundant server should have a tape drive attached to facilitate retrieving the information from the last archive tape.

B. SYSTEM PREPARATION

1. Backup whatever is left of the current system

Use the tape backup section of this manual to backup the partitions of the disk which still may be functioning. If the disk is completely unresponsive and needs to be replaced, then skip this step, however keep the disk in case data retrieval becomes necessary.

2. Repartition

Use the instructions in the earlier chapters to reformat the disk and load the UNIX operating system. How you partition the drive will depend upon whether this will be the database server or another client workstation.

3. Retrieve System Backup

Use the system backup performed prior to the disk crash to restore the system parameters and user directories. The following commands may be used to extract information from the multiple dump files stored on your system archive tape. This procedure should be performed by our professional installation staff so as not to contaminate the new operating system with corrupt or inappropriate files.

Insert the most recent system archive tape into the tape drive attached to the system. If there is not tape drive attached, relocate one from another workstation for the purposes of this procedure.

setenv TAPE /dev/nrcht0

set the tape device for all subsequent commands. Make sure to use the non-rewinding device otherwise the tape drive will not treat the multiple tape files as separate partition files.

mt rew

Rewind the system tape to the beginning of the tape

mt fsf n	Skip n number of partition files till you get to the one you desire.
restore -I	Enter the restore command in interactive mode, you will be able to select the directories and individual files you want to restore in this program. Consult with the Administrator's guide for more information regarding this program.

Use these commands to restore the necessary system files from the archive tape prior to restoring the database. The following list is a partial list of files which should be restored, however consult with our technical support hotline as this list may have changed slightly.

```

/etc/passwd
/etc/group
/etc/hosts
/etc/exports
/etc/printcap
/etc/rc.local
/etc/services
/etc/remote
/etc/ttytab
/etc/gettytab
/usr/openwin/etc/NeWS/paintroot.ps
/opt/ISTri      (entire directory)
/opt/informix   (entire directory)
/export/home/imaging      (entire directory)
/export/home/user (entire directory for each user)
/img/print      (entire directory)
/img/templates (entire directory)
/img/defaults  (entire directory)
/db             (entire database directory)

```

Do not restore the image directory, since these patient exams will not be recognized by the most current database backup which will be retrieved from the last patient archive tape.

When these directories and files have been retrieved, the only remaining step is retrieve the databases from the archive tape that was initialized last. This tape will have the most current backup of the database.

C. RIBUILD - RETRIEVE DATABASE FROM ARCHIVE TAPE

Use the following procedure to restore the most current copy of the databases from the patient archive tape which was most recently initialized. This tape will contain backups of the following databases: rilogin, radiology.

If you are using a redundant server, make sure that the /db directory exists, and has space sufficient for the new database information. Also make sure that it has appropriate user privileges for access by world. Backup and remove any existing databases from this partition if their names will conflict with the database names being retrieved (rilogin.dbs and radiology.dbs). Contact your system administrator to perform this operation.

If multiple databases were used, then you may need to insert the last tape from a tape set which archived those exams to restore and rebuild those patient databases. If multiple

databases were used, however they were located on different workstations (this is highly probable), then these databases were probably not affected by the crash and the restoration of the rilogin database should fix the problem.

If the rilogin database was on a system which did not crash, then only the patient database on the faltering workstation has probably been affected. Even so, the following procedure will restore both the rilogin and patient databases, so the other users should be notified not to use the system until this process is complete.

- Make sure that the applications “add_pt_to_arc” and “ribuild” exist in the IST binary directory “/home/ist/bin” or “/opt/ISTri/bin”. If these files do not exist, retrieve them from the Solaris installation cd using “pkgadd”.
- Change to the *RI* system home directory "cd /home/ist/bin or /opt/ISTri/bin"
- Insert the most current archive tape into the tape drive.
- Run the script "**ribuild**".

When this program finishes, you will be able access all of the archive information and the exams stored on tape. The new system will still be able to use exams on other systems which were not affected. However the exams on the database system were probably lost. Use **rimove** to delete these exams and make sure to write the exams down so that they can be imported again from the scanner or retrieved from the primary tape.

If a redundant server was used to load the database information into the /db partition, then all the accounts on the Rational Imaging workstations must be configured to look at the new server. Modify the **.cshrc** file in each account (especially “imaging”) to specify the new **RILOGDB** and **DBPATH** parameters. Also, the database information in rilogin will need to be changed to alter the location of the patient database(s). Use **risetup** to modify the database information to establish the new server location. The **./profile** file should also be updated if it exists on any of the Solaris workstations.

D. REDUNDANT SERVER

In large networks where the requirement of server uptime is critical, it may be important to create a redundant server which could be quickly configured as the database server in the event of a server crash. This system would contain the Rational Imaging and Informix applications found on the server system. In particular, this system would have the **Informix SE** (standard engine) and the **SQL** (standard query language interface) present and licensed.

In addition, the partition on the redundant server should include a “**db**” partition which is empty and ready for the database files in the event of an emergency.

It would also be important to have a tape drive attached to this system which could be used to load the database files from the recent archive tapes.

Keep the **RIbuild** applications present at all times on this system so that the rebuild operation would be very quick. These files include the “ribuild” script, and the “add_pt_to_arc” executable file. These should be located in the /home/ist/bin directory on the SunOS systems, and in the /opt/ISTri/bin directory of the Solaris systems.

Operation of these scripts should be performed on a periodic basis to ensure proper operation. The testing and operation of these scripts on a redundant server will not affect the operation of the Rational Imaging system, since the database files are actually being used from the original server. Remove the files from “/db” after the test is complete.

XXIX. Installation Worksheet

A. SUMMARY

Use the following worksheets to document the installation, and lead you through the setup and testing. Use the individual chapters to obtain more detail regarding the individual steps.

In preparation for an installation, make sure that all the checkmarks (✓) have been filled in. Then proceed with the installation and mark each item as it is completed. Make copies of these pages for each item installed at the facility. This will act not only as a guidance mechanism, but also as installation documentation.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

B. WORKSTATION IS THE MAIN DATABASE SERVER

- ✓ Location at facility (diagram): _____
- ✓ Network cabling and power completed: _____
- ✓ Hostname (recommend lowercase): _____
- ✓ IP address and SubNet: _____
- ✓ MAC Address: _____
- ✓ Default Router IP address: _____
- ✓ Alias for host (may be upper/lower): _____
- ✓ Root password: _____
- ✓ Imaging password: _____
- ✓ Serial number: _____
- ✓ Host ID number: _____
- ✓ Hostname of redundant server: _____
- ✓ IP address of redundant server: _____
- ✓ 10 or 100 Mbit Ethernet: _____
- ✓ Total RAM required: _____
- ✓ Swap space required (> 2x RAM): _____
- ✓ Software to install: _____
- ✓ SBUS/PCI cards (video/ethernet/scsi): _____
- ✓ SCSI IDs of Disk Drives: _____
- ✓ UPS recommended to facility: _____
- ✓ Computer grade modem line for support – Number: _____
- ✓ Informix SE license: _____
- ✓ Informix SQL license: _____
- ✓ Informix INET license: _____
- ✓ Rational Imaging license file/email: _____
- ☐ Install Solaris (partitions /db and /img required)
- ☐ Install ISTdb723 using pkgadd (Informix database)
- ☐ Install ISTmain using pkgadd (Rational Imaging components)
- ☐ Install ISTri using pkgadd (Rational Imaging applications)
- ☐ Execute /opt/ISTri/install/install_informix script
- ☐ Execute /opt/ISTri/install/install_main script
- ☐ Add workstation to “/etc/inet/hosts” **on ALL workstations**
- ☐ Add workstation to “/etc/hosts.equiv” **on ALL workstations**
- ☐ Create /etc/defaultrouter with the correct IP address (if necessary)
- ☐ Add licenses (/opt/ISTri/bin/add_license < license_file)
- ☐ Check parameters in expire_locks, reset_modems
- ☐ Check parameters in /etc/inittab
- ☐ Specify redundant server (/opt/ISTri/bin/ridundant configure)
- ☐ Configure /opt/ISTri/bin/backup_radiology (one needed for each database)
- ☐ Check /etc/services and make sure that sqlexec is at port number 1525 (first server)
- ☐ Reboot
- ☐ Login as imaging
- ☐ Use dmesg to make sure that all monitors have correct resolution
- ☐ Make sure maintenance menu available and functions (reboot, halt etc).
- ☐ Check window layout, background color, main menu and rilogin loaded.

- ❑ Save workspace under main workspace menu utilities.
- ❑ Once the rilogin.dbs database has been configured, copy to /db on redundant server.
- ❑ Make sure that the “ridundant” server script works correctly.
- ❑ Make sure that the “backup_radiology” server script works correctly.
- ❑ Drag SMPTE image into Riport and display in Riview.
- ❑ Calibrate monitor if required. This should be done under normal lighting at the facility.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

C. WORKSTATION IS THE REDUNDANT DATABASE SERVER

- ✓ Location at facility (diagram): _____
- ✓ Network cabling and power completed: _____
- ✓ Hostname of server: _____
- ✓ IP address of server: _____
- ✓ Hostname (recommend lowercase): _____
- ✓ IP address and SubNet: _____
- ✓ MAC Address: _____
- ✓ Default Router IP address: _____
- ✓ Alias for host (may be upper/lower): _____
- ✓ Root password: _____
- ✓ Imaging password: _____
- ✓ Serial number: _____
- ✓ Host ID number: _____
- ✓ 10 or 100 Mbit Ethernet: _____
- ✓ Total RAM required: _____
- ✓ Swap space required (> 2x RAM): _____
- ✓ Software to install: _____
- ✓ SBUS/PCI cards (video/ethernet/scsi): _____
- ✓ SCSI IDs of Disk Drives: _____
- ✓ UPS recommended to facility: _____
- ✓ Computer grade modem line for support – Number: _____
- ✓ Informix SE license (if purchased): _____
- ✓ Informix SQL license (if purchased): _____
- ✓ Informix INET license: _____
- ✓ Rational Imaging license file/email: _____
- ☐ Install Solaris (partitions /db and /img required)
- ☐ Install ISTdb723 using pkgadd (Informix database)
- ☐ Install ISTsat using pkgadd (Rational Imaging components)
- ☐ Install ISTri using pkgadd (Rational Imaging applications)
- ☐ Execute /opt/ISTri/install/install_informix script
- ☐ Execute /opt/ISTri/install/install_sat script
- ☐ Add workstation to “/etc/inet/hosts” **on ALL workstations**
- ☐ Add workstation to “/etc/hosts.equiv” **on ALL workstations**
- ☐ Create /etc/defaultrouter with the correct IP address (if necessary)
- ☐ Add host to clinical and rilogin database on master rilogin server (risetup)
- ☐ Add image directory to database on master rilogin server (risetup)
- ☐ Add licenses on master rilogin server (/opt/ISTri/bin/add_license < license_file)
- ☐ Check parameters in expire_locks, reset_modems
- ☐ Check parameters in /etc/inittab
- ☐ Configure /opt/ISTri/bin/backup_radiology (one needed for each database)
- ☐ Check /etc/services and make sure that sqlxec is at port number 1525 (first server)
- ☐ Add sqlredun at port number 1526 (redundant server) to ALL servers (/etc/services)
- ☐ Modify /etc/init.d/ri.install to add sqlredun after sqlxecd “sqlxecd sqlredun &”.
- ☐ If SQL/SE licenses purchased, delete * in /opt/informix and reload SQL/SE/INET
- ☐ Create /opt/informix/etc/sqlhosts to support the existing and new servers
- ☐ Copy /opt/informix/etc/sqlhosts to ALL servers (specifying ALL servers)

- ❑ Run scripts to install SQL/SE/INET in that order (scripts in /opt/informix).
- ❑ Make sure software on this workstation is same version as Main Server.
- ❑ Reboot
- ❑ Login as imaging
- ❑ Use dmesg to make sure that all monitors have correct resolution
- ❑ Make sure maintenance menu available and functions (reboot, halt etc).
- ❑ Check window layout, background color, main menu and rilogin loaded.
- ❑ Save workspace under main workspace menu utilities.
- ❑ When the server's rilogin.dbs database is configured, copy to /db on redundant server.
- ❑ Make sure that the "backup_radiology" server script works correctly.
- ❑ Drag SMPTE image into Riport and display in Riview.
- ❑ Calibrate monitor if required. This should be done under normal lighting at the facility.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

D. WORKSTATION IS MULTIPLE DATABASE SERVER IN A NETWORK

- ✓ Location at facility (diagram): _____
- ✓ Network cabling and power completed: _____
- ✓ IP address and SubNet: _____
- ✓ MAC Address: _____
- ✓ Default Router IP address: _____
- ✓ Hostname (recommend lowercase): _____
- ✓ Alias for host (may be upper/lower): _____
- ✓ Root password: _____
- ✓ Imaging password: _____
- ✓ Serial number: _____
- ✓ Host ID number: _____
- ✓ Hostname of redundant server: _____
- ✓ IP address of redundant server: _____
- ✓ Hostname of other servers: _____
- ✓ IP address of other servers: _____
- ✓ New Database name: _____
- ✓ SQLexec port # of other servers: 1525, 1526, _____
- ✓ SQLexec service name of other servers: sqlexec, sqlredun, _____
- ✓ 10 or 100 Mbit Ethernet: _____
- ✓ Total RAM required: _____
- ✓ Swap space required (> 2x RAM): _____
- ✓ Software to install: _____
- ✓ SBUS/PCI cards (video/ethernet/scsi): _____
- ✓ SCSI IDs of Disk Drives: _____
- ✓ UPS recommended to facility: _____
- ✓ Computer grade modem line for support – Number: _____
- ✓ Informix SE license: _____
- ✓ Informix SQL license: _____
- ✓ Informix INET license: _____
- ✓ Rational Imaging license file/email: _____
- ☐ Install Solaris (partitions /db and /img required)
- ☐ Install ISTdb723 using pkgadd (Informix database)
- ☐ Install ISTmain using pkgadd (Rational Imaging components)
- ☐ Install ISTri using pkgadd (Rational Imaging applications)
- ☐ Execute /opt/ISTri/install/install_informix script
- ☐ Execute /opt/ISTri/install/install_main script
- ☐ Add workstation to “/etc/inet/hosts” **on ALL workstations**
- ☐ Add workstation to “/etc/hosts.equiv” **on ALL workstations**
- ☐ Create /etc/defaultrouter with the correct IP address (if necessary)
- ☐ Add host to clinical and rilogin database on master rilogin server (risetup)
- ☐ Add image directory to database on master rilogin server (risetup)
- ☐ Add licenses on master rilogin server (/opt/ISTri/bin/add_license < license_file)
- ☐ Check parameters in expire_locks, reset_modems
- ☐ Check parameters in /etc/inittab
- ☐ Specify redundant server (/opt/ISTri/bin/ridundant configure)
- ☐ Configure /opt/ISTri/bin/backup_radiology (one needed for each database)
- ☐ Add sqlNAME at port number 152# (unique number) to ALL servers (/etc/services)
- ☐ Modify /etc/init.d/ri.install to add sqlNAME after sqlexecd “sqlexecd sqlNAME &”.
- ☐ Create /opt/informix/etc/sqlhosts to support this new server

- ❑ Make sure that /etc/services and /opt/informix/etc/sqlhosts contain ALL servers.
- ❑ Copy /opt/informix/etc/sqlhosts to ALL workstations (specifying ALL servers)
- ❑ Copy /etc/services info to ALL workstations (specifying ALL servers)
- ❑ Make sure that /home/imaging/.cshrc has DBPATH for master rlogin server
- ❑ Make sure that /.profile has DBPATH for **master** rlogin server
- ❑ Login to host of master rlogin database. Add new database (risetup)
- ❑ Make sure software on this workstation is same version as Main Server.
- ❑ Reboot
- ❑ Login as imaging
- ❑ Use dmesg to make sure that all monitors have correct resolution
- ❑ Check window layout, background color, main menu and rlogin loaded.
- ❑ Save workspace under main workspace menu utilities.
- ❑ Make sure maintenance menu available and functions (reboot, halt etc).
- ❑ Make sure that the “backup_DBNAME” server script works correctly.
- ❑ Configure “/etc/inittab” for new database name (other than radiology).
- ❑ Configure “/opt/ISTri/bin/backup_DBNAME”.
- ❑ Configure “/opt/ISTri/bin/expire_locks”.
- ❑ Configure “/opt/ISTri/bin/reset_modems”.
- ❑ Drag SMPTE image into Riport and display in Riview.
- ❑ Calibrate monitor if required. This should be done under normal lighting at the facility.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

E. WORKSTATION IS THE SATELLITE WORKSTATION

- ✓ Location at facility (diagram): _____
- ✓ Network cabling and power completed: _____
- ✓ IP address and SubNet: _____
- ✓ MAC Address: _____
- ✓ Default Router IP address: _____
- ✓ Hostname (recommend lowercase): _____
- ✓ Alias for host (may be upper/lower): _____
- ✓ Root password: _____
- ✓ Imaging password: _____
- ✓ Serial number: _____
- ✓ Host ID number: _____
- ✓ 10 or 100 Mbit Ethernet: _____
- ✓ Total RAM required: _____
- ✓ Swap space required (> 2x RAM): _____
- ✓ Software to install: _____
- ✓ SBUS/PCI cards (video/ethernet/scsi): _____
- ✓ SCSI IDs of Disk Drives: _____
- ✓ UPS recommended to facility: _____
- ✓ Informix INET license: _____
- ✓ Rational Imaging license file/email: _____
- ☐ Install Solaris (ONLY /img partition required, DO NOT put /db)
- ☐ Install ISTdb723 using pkgadd (Informix database)
- ☐ Install ISTsat using pkgadd (Rational Imaging components)
- ☐ Install ISTri using pkgadd (Rational Imaging applications)
- ☐ Execute /opt/ISTri/install/install_informix script
- ☐ Execute /opt/ISTri/install/install_sat script
- ☐ Add workstation to "/etc/inet/hosts" **on ALL workstations**
- ☐ Add workstation to "/etc/hosts.equiv" **on ALL workstations**
- ☐ Create /etc/defaultrouter with the correct IP address (if necessary)
- ☐ Add host to clinical and rilogin database on master rilogin server (risetup)
- ☐ Add image directory to database on master rilogin server (risetup)
- ☐ Add licenses on master rilogin server (/opt/ISTri/bin/add_license < license_file)
- ☐ Check parameters in load_riconnect, load_dicom, expire_locks, reset_modems
- ☐ Check parameters in /etc/inittab
- ☐ Specify redundant server (/opt/ISTri/bin/ridundant configure)
- ☐ Configure /opt/ISTri/bin/backup_radiology (one needed for each database)
- ☐ Edit /etc/services file to include all server ports.
- ☐ Edit /opt/informix/etc/sqlhosts to include multiple servers.
- ☐ Make sure software on this workstation is same version as Main Server.
- ☐ Reboot
- ☐ Login as imaging
- ☐ Use dmesg to make sure that all monitors have correct resolution
- ☐ Check window layout, background color, main menu and rilogin loaded.
- ☐ Save workspace under main workspace menu utilities.
- ☐ Make sure maintenance menu available and functions (reboot, halt etc).

- ❑ Make sure that the “backup_radiology” server script works correctly.
- ❑ Drag SMPTE image into RIport and display in RView.
- ❑ Calibrate monitor if required. This should be done under normal lighting at the facility.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

F. WORKSTATION IS A STAFF WORKSTATION (RIDISPLAY)

- ✓ Location at facility (diagram): _____
- ✓ Network cabling and power completed: _____
- ✓ IP address and SubNet: _____
- ✓ MAC Address: _____
- ✓ Default Router IP address: _____
- ✓ Hostname (recommend lowercase): _____
- ✓ Alias for host (may be upper/lower): _____
- ✓ Root password: _____
- ✓ Imaging password: _____
- ✓ Serial number: _____
- ✓ Host ID number: _____
- ✓ 10 or 100 Mbit Ethernet: _____
- ✓ Total RAM required: _____
- ✓ Swap space required (> 2x RAM): _____
- ✓ Software to install: ridisplay
- ✓ SBUS/PCI cards (video/ethernet/scsi): _____
- ✓ SCSI IDs of Disk Drives: _____
- ✓ Informix INET license: _____
- ✓ Rational Imaging license file/email (ridisplay): _____
- ☐ Install Solaris (ONLY /img partition required, DO NOT create /db)
- ☐ Install ISTdb723 using pkgadd (Informix database)
- ☐ Install ISTsat using pkgadd (Rational Imaging components)
- ☐ Install ISTri using pkgadd (Rational Imaging applications)
- ☐ Execute /opt/ISTri/install/install_informix script
- ☐ Execute /opt/ISTri/install/install_sat script
- ☐ Add workstation to "/etc/inet/hosts" **on ALL workstations**
- ☐ Add workstation to "/etc/hosts.equiv" **on ALL workstations**
- ☐ Create /etc/defaultrouter with the correct IP address (if necessary)
- ☐ Add host to clinical and rlogin database on master rlogin server (risetup)
- ☐ Add image directories to database on master rlogin server (risetup)
- ☐ Add licenses on master rlogin server (/opt/ISTri/bin/add_license < license_file)
- ☐ Edit /etc/services file to include all server ports. (Copy from main server)
- ☐ Edit /opt/informix/etc/sqlhosts to include multiple servers. (Copy from main server)
- ☐ Make sure software on this workstation is same version as Main Server.
- ☐ Remove "r1, r2, r3" from the /etc/inittab file. This workstation will not be receiving images.
- ☐ Make sure that the /home/imaging/.openwin-menu file contains the following:
 - "Imaging" DEFAULT exec \$RIPROGDIR/run_program ridisplay
- ☐ Reboot
- ☐ Login as imaging
- ☐ Check window layout, background color, main menu and ridisplay loaded.
- ☐ Save workspace under main menu utilities when screen correct
- ☐ Check that Ridisplay exists in the main workspace menu.
- ☐ Use dmesg to make sure that all monitors have correct resolution
- ☐ Make sure maintenance menu available and functions (reboot, halt etc).

- Display SMPTE image in RIdisplay. Calibrate monitor if required.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

G. EXTRA IMAGE PARTITION/DISK (OTHER THAN /IMG)

- ✓ Unix name (syntax: /net/hostname/img2): _____
- ✓ SCSI chain terminated with ACTIVE terminator (SCSI II, SCSI III): _____
- ✓ Power available (plug into UPS if available): _____
- ✓ SCSI cable type (scsi II, U/W, conversion required): _____
- ✓ SCSI IDs of Disk Drives: _____
- ☐ Halt the system, set the SCSI ID and attach the drive.
- ☐ Reboot using “boot -r” to make sure that the new drive is recognized.
- ☐ Format and Create Unix filesystem on new disk (make sure to extract defect list)
- ☐ Fsck new disk to check for errors
- ☐ Mount the new disk and add to /etc/vfstab
- ☐ Change ownership and permission on partition (u=imaging g=imaging a+rwx)
- ☐ Add export partition in **/etc/dfs/dfstab**
- ☐ Type “**shareall**” to make the new dfstab file active
- ☐ Type “**share**” to make sure that all the partitions are shared (/db, /img, /img1...)
- ☐ Reboot and make sure image directory available from other workstations
- ☐ If multiple databases exist, syntax for directory is “/net/hostname/img/db_name”
- ☐ If multiple databases exist and will use /img#, create db_name dirs under /img#
- ☐ If multiple database directory used, make sure a+rwx permission.
- ☐ Login to server and use risetup to add the new image directory.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

H. EXTRA SUN COLOR MONITOR(S)

- ✓ SBUS video card ordered (supports 1280x1024): _____
- ❑ Shutdown system and install the SBUS Turbo GXplus Video card
- ❑ Reboot using `-r` to recognize the new video card and monitor
- ❑ Use `dmesg` to see the device name (`cgsix#`) and check resolution of video cards
- ❑ If CDE, copy `/usr/dt/config/Xconfig` & `/usr/dt/config/Xservers` to `/etc/dt/config`.
- ❑ Add device name to `.login` after `openwin` (`-dev /dev/cgsix#`) (or add to `/etc/dt/config/Xservers` for Solaris 2.6 CDE)
- ❑ `LEFT` and `RIGHT` can be added after `cgsix#` to reposition.
- ❑ The first device after `openwin` will be the console (place console on left).
- ❑ Login as `imaging` and make sure that the Solaris graphic appears on ALL monitors. On Solaris 2.6, the Solaris banner will only appear on the console, however once the system is up the background should appear on all the monitors and the mouse should be able to move to all the monitors in sequence.
- ❑ Adjust the brightness and contrast of the monitor. Usually set to max as long as text distortion is not observed.
- ❑ Display SMPTE on new monitor and calibrate monitor if necessary to display b/w range.
- ❑ Use `risetup` to add the monitor calibration parameters (42).

FACILITY: _____ DATE: _____ INSTALLED BY: _____

I. INSTALL DOME VIDEO ADAPTER WITH DATARAY MONITOR

- ✓ Hostname: _____
- ✓ Video Card: _____
- ✓ Monitor and Model: _____
- ✓ Version: _____
- ✓ DOME card ordered specific for this monitor: _____
- ✓ Correct cable available for single/dual monitor(s): _____
- ✓ Correct drivers for video card and monitors(s): _____
- ❑ Change necessary jumpers on the video card per manufacturers recommendations for Sun workstations. On a md2pci card, jumper J4 should not be shorted (put over only 1 pin).
- ❑ Install the video card in any of the pci slots of the workstation. Make sure that the gold contacts are firmly seated in the socket.
- ❑ Reboot and reconfigure the workstation "boot -r"
- ❑ Use dmesg to see the device name (md####) and check resolution of video cards
- ❑ Change the video mode for the monitor. For the DataRay monitor, the resolution must be set to 1200x1600 @ 66Hz. "/opt/DOMEmd2pci/util/video_mode -d /dev/md2pci0.0 -m F". Similarly set "/dev/md2pci0.1". The monitor may not sync properly until you reboot at the end of this install procedure.
- ❑ Backup and modify the file "/usr/openwin/server/etc/OWconfig" to contain the following:

```
class="XSCREENCONFIG" name="DOMEmd2pci0Config"
device="/dev/md2pci0.0"
res="1200x1600 @ 66Hz"
monitor="domegray.vda"
board="md2pci-2hd.xqa";
class="XSCREENCONFIG" name="DOMEmd2pci1Config"
device="/dev/md2pci0.1"
res="1200x1600 @ 66Hz"
monitor="domegray.vda"
board="md2pci-2hd.xqa";
class="XSCREEN" name="DOMEmd2pci"
ddxHandler="ddxDOMEmd2pci.so.1" ddxInitFunc="domeMd2pSunInit";
```

- ❑ If CDE, copy /usr/dt/config/Xconfig & /usr/dt/config/Xservers to /etc/dt/config.
- ❑ Backup and modify "/etc/dt/config/Xservers to contain the video drivers so that OpenWindows will know that multiple monitors exist as follows: (example for 1 Sun monitor and 2 DataRey monitors on 1 Dome card)

```
#Sun & 2 greyscale monitors on a single DOME card (Use dmesg to confirm)
:0 Local local_uid@console root /usr/openwin/bin/Xsun :0 -nobanner -dev
/dev/fb0 -dev /dev/md2pci0.0 -dev /dev/md2pci0.1
```

- ❑ Reboot the workstation "reboot -- -r". The monitor should sync-up at this point and display a DOME banner. You should also see a DOME message appear before the Sun banner during boot. If this message is not shown, try the adapter in another PCI slot and confirm that it is seated properly.
- ❑ If the X Server is unable to start, check the Xservers file for accuracy. Check to see that drivers have been created in /dev (md2pci0.0 and mc2pci0.1). Check that the spelling and context is correct for these entries in Xservers and OWconfig.

- ❑ Login as imaging and make sure that the Solaris graphic appears on ALL monitors. On Solaris 2.6, the Solaris banner will only appear on the console, however once the system is up the background should appear on all the monitors and the mouse should be able to move to all the monitors in sequence.
- ❑ Adjust the brightness and contrast of the monitor. Usually set to max as long as text distortion (blurring) is not observed.
- ❑ Display SMPTE on new monitor and calibrate monitor if necessary to display b/w range.
- ❑ Use risetup to add the monitor calibration parameters (42).

FACILITY: _____ DATE: _____ INSTALLED BY: _____

J. CANON POSTSCRIPT PRINTER(S)

- ✓ Hostname: _____
- ✓ Print Queue name (eg: xjprint *specific to printer*): _____
 Note: CLBP should use **xjdirect** if < 32MB of Ram on printer
 460 requires **xjdirect** print queue name
- ✓ Printername (if different than hostname): _____
- ✓ Printer alias (name shown in Menus): _____
- ✓ IP address: _____
- ✓ Network cabling and power available: _____
- ❑ Add printer IP address and hostname to the **/etc/hosts** file on **ALL systems**.
- ❑ Configure printer - press Menu when asked during powerup (**Hostname, IP address, TCP/IP**). *The hostname of this printer must be unique.* The hostname on the printer must equal the value in the /etc/hosts table and the hostname used in configuring the printer below.
- ❑ Ping the printer to make sure that the system sees it on the network.
- ❑ Add printer to **all hosts** using the following commands (Replace the hostname and printername parameters with the actual hostname and printername from above):


```
lpsystem -t bsd hostname
lpadmin -p printername -s hostname!xjprint
      (replace the xjprint with print_700-800 if needed)
lpadmin -p printername -T any -I PS (omit "-T any" on Sol 2.5.1)
accept printername
enable printername
```
- ❑ Test printer with "**lp -d printername /home/imaging/.login**"
- ❑ Make sure that /var/spool/lp/tmp has been redirected to /img/print/tmp for space.
- ❑ Login to server and add printer to database using risetup (8)

Script to add a Canon printer:

```
#!/bin/sh
# Little script to setup printers for solaris 2.5.1 and 2.6
echo "Printer host name: \c"
read PRTHOST
echo "Printer queue name (xjprint, print_700-800): \c"
read QUEUE
echo "Printer name in unix: \c"
read PRINTER

lpsystem -t bsd $PRTHOST
lpadmin -p $PRINTER -s $PRTHOST:$QUEUE
lpadmin -p $PRINTER -I any
```

FACILITY: _____ DATE: _____ INSTALLED BY: _____

K. SEEMOR REFERRING WORKSTATION PRINTER(S)

- ✓ Hostname: _____
- ✓ Printer alias (name shown in Menus): _____
- ✓ IP address: _____
- ❑ Add Seemor Workstation IP address to the /etc/hosts file on ALL systems.
- ❑ Ping the workstation to make sure that the system sees it on the network.
- ❑ Add WarFTP to the SeeMor workstation. Configure to allow a user “imaging” access to the c:/seemor/images and c:/seemor/print directories. Make sure that “imaging” has a password assigned, or ftp will not work.
- ❑ Test the ftp client by ftping from a Sun into the workstation, cd to “c:/seemor/print”, and depositing test files. If there are any permission errors, reconfigure the WarFTP correctly.
- ❑ Add the workstation host in risetup as type 6 (Referring SeeMor host).
- ❑ Add printer to the database using risetup on the server as follows:
 - Name:** any name (no spaces allowed)
 - Alias:** name to appear in Menus (no spaces allowed)
 - Type:** 3 (SeeMor B/W printer)
 - HostKey:** HostKey of host (Add host first in risetup)
 - PrintDir:** /img/print (default location for temporary print pages)
 - Width:** 850 (8.5” default)
 - Height:** 1100 (11” default)
 - Resolution:** 160 (so the print page will fit on HP printers)
 - PrintCmd:** /opt/ISTri/print/print2seemor riFILE riHOST
 - JpegQual:** 50 (Can be changed to 75 to improve quality)
 - PtInfo:** 1 (This will print the patient information also)
- ❑ Test printer using RView

FACILITY: _____ DATE: _____ INSTALLED BY: _____

L. REMOTE LOW-BANDWIDTH WORKSTATION PRINTER(S)

- ✓ Hostname: _____
- ✓ Unix printer name: _____
- ✓ Printer alias (name shown in Menus): _____
- ✓ IP address: _____
- ❑ Add Remote Workstation IP address to the /etc/hosts file on ALL systems.
- ❑ Add the host using risetup to rilogin and all databases.
- ❑ Ping the workstation to make sure that the system sees it on the network.
- ❑ Add the **/opt/ISTri/bin/riprint** and **/opt/ISTri/print/print_remote** applications on the remote workstation. This will decompress the JPEG print pages and print them using the standard lp process.
- ❑ Configure the **/opt/ISTri/print/print_remote** application for the correct printer.
- ❑ Create the printpage directory specified in print_remote. Make sure that it has “chmod 777” permissions and the owner and group are imaging.
- ❑ Add the **/opt/ISTri/print/print_jpeg** application to the Canon RI workstations.
- ❑ Add a printer on the remote workstation using admintool.
- ❑ Test the printer on the remote workstation using lp.
- ❑ Make sure that the remote workstation allows “imaging” to remote shell into it without a password. Needs a “.rhosts” file containing “+ +” in the /home/imaging directory of the remote system.
- ❑ Add the workstation host in risetup as type 5 (Rational Imaging host).
- ❑ Add printer to the database using risetup on the server as follows:
 - Name: any Unique name – (eg: HostPrinter) (no spaces allowed)
 - Alias: name to appear in Menus (no spaces allowed)
 - Type: 6 (Color JPEG compressed print pages)
 - HostKey: HostKey of host (Add host first in risetup)
 - PrintDir: /img/print (default location for temporary print pages)
 - Width: 850 (8.5” default)
 - Height: 1100 (11” default)
 - Resolution: 80 (so the print page will fit on HP printers)
 - PrintCmd: /opt/ISTri/print/print_jpeg riHOST riIMGHOST riPATH riPTNAME
 - JpegQual: 75 (Can be changed to 50 to improve speed)
 - PtInfo: 1 (This will print the patient information also)
- ❑ Test printer using RView.
- ❑ The resolution can be increased from 80, but this increases network transfer time, makes it rather large to view on the remote station, and if the printpage is to be reprinted using imagetool, the image will need to be resized first. A dpi of 80 just fits on an HP print page. A dpi of 160 can be used, however the image should be reduced by 50% before printing using imagetool.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

M. FILM (LASERLINK) PRINTER

- ✓ SparcStation compatible with Card: _____
- ✓ Kodak (3M) engineer notified: _____
- ✓ Kodak (3M) digital port purchased and installed: _____
- ✓ Kodak (3M) digital port configured to Cemax specs: _____
- ✓ Cables extending from Sun to Kodak (3M): _____
- ☐ Shutdown system
- ☐ Install LaserLink card in SCSI slot 0 (bottom nearest processors)
- ☐ Install cables to LaserLink card and to Kodak (3M)
- ☐ Reboot with -r to have system recognize new hardware
- ☐ Install ISTfilm package
- ☐ Change directory to /opt/ISTri/film
- ☐ Check the README file for any system patches that need to be applied.
- ☐ Install drivers "/opt/ISTri/film/INSTALL
- ☐ Run /opt/ISTri/film/addcam in that directory to create camcap file
- ☐ Edit camcap and change DefFormat="1 on 1"
- ☐ Edit camcap and change MaxHSize and MaxVSize = 6000 (under 1 on 1).
- ☐ Link camcap ("ln -s /opt/ISTri/film/camcap /opt/ISTri/bin/camcap")
- ☐ Link filmer ("ln -s /opt/ISTri/film/filmer /opt/ISTri/bin/filmer")
- ☐ Test printer with filmer "filmer -c camcap kodak.fjob1"
- ☐ License rifilm for that workstation (add_license < licfile)
- ☐ Start rifilm in the background using load_riconnect (it will watch /img/film directory)
- ☐ Check world r+w permission on /img/film
- ☐ Create a new printer (film printer) in risetup on server
- ☐ Use RView to send some images to the Cemax Laserlink (/net/cemaxhost/img/film).
- ☐ Make sure the images in /img/film are printed and deleted.
- ☐ If problems persist, try setting the Cemax card with Odd parity.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

N. VIRTUALRAD PRINTER

- ✓ Printer Name (same as Alias): _____
- ✓ Directory Share Hostname: _____
- ✓ Shared Directory for temporary reports (/net/host/img/vr): _____
- ❑ Create the new directory /img/vr on the share host. Choose a system which has plenty of disk space.
- ❑ Check to make sure that /net/img/vr is shared. Type “share” to see the current shares.
- ❑ Setup Samba on the share host so that VirtualRad can see this shared directory (See Samba whitepaper).
- ❑ Configure the Dropbox Watcher on VirtualRad to watch this directory “/net/host/img/vr”.
- ❑ Create a new printer in RIssetup with the following parameters.
 Name=VirtualRad (This name can be site specific)
 Alias=VirtualRad (Same as Name field)
 Type: 7 (SeeMor Color PrintPage with Thumbnails)
 Host: # (Select host for shared directory)
 Print Dir: /net/host/img/vr (Create /img/vr on host;chmod 777)
 Width: 850
 Height: 1100
 DPI: 80
 Print Command: (Leave blank)
 Jpeg Quality: 50
 Pt Info: 1
- ❑ Use riview to test the printer.
- ❑ To automatically have all print pages sent to VirtualRad, create a default service using dbaccess as follows. Replace ‘#’ with the prt_key of the VirtualRad printer. Prt_key can be obtained in risetup by listing the printers:
 Echo “Insert into services values (0,1,0,0,0,0,0,1,#,0,0,0,0,0,0,0)” | dbaccess radiology

FACILITY: _____ DATE: _____ INSTALLED BY: _____

O. DICOM PRINTER

- ✓ Hostname: _____
- ✓ Printer Manufacturer (or DICOM PRINT SCP gateway): _____
- ✓ Printer configured for Canon PACS: _____
- ✓ Printer seen on network (ping): _____
- ❑ Enter correct configuration parameters in /opt/ISTri/etc/riprintq_cfg (page 73).
- ❑ Put riprintq in /etc/inittab.
r5:34:respawn:su – imaging –c “exec riprintq –c /opt/ISTri/etc/riprintq_cfg”
- ❑ Initialize riprintq “init Q”.
- ❑ Verify that riprintq is running “ps –ef | grep riprintq”.
- ❑ Use risetup to enter a DICOM printer. (see page 73)
- ❑ Use riview to test the printer.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

P. GE CT & MR SCANNERS (5X AND ABOVE USING ADVANTAGENET)

- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of scanner: _____
- ✓ Hostname of scanner: _____
- ❑ Add hostname and IP address to /etc/inet/hosts file **on ALL workstations**
- ❑ Add host to clinical and rilogin database (risetup)
- ❑ Ping the scanner from the workstation which will receive the images
- ❑ Use setAdoption on scanner to establish a Advantagenet Sun client.
- ❑ Run RIport, change source to scanner, and see if patient's listed. Try receiving.
- ❑ Make sure that riconnect and riupdate are running (load_riconnect)
- ❑ Try sending images from scanner (Network button on console)

FACILITY: _____ DATE: _____ INSTALLED BY: _____

Q. GE MR SCANNERS (SIGNA 4X)

- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of scanner: _____
- ✓ Hostname of scanner: _____
- ❑ Add hostname and IP address to /etc/inet/hosts file **on ALL workstations**
- ❑ Add host to clinical and rilogin database (risetup)
- ❑ Ping the scanner from the workstation which will receive the images
- ❑ Run RIport, change source to scanner, and see if patient's listed. Try receiving.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

R. DICOM SCANNERS

- ✓ AE_TITLE: _____
- ✓ DICOM Port # (default=104 – MUST BE UNIQUE): _____
- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of scanner: _____
- ✓ Hostname of scanner: _____
- ✓ Give scanner engineer our info: (AE_TITLE=RI_DICOM, default Port=104)
- Add hostname and IP address to **/etc/inet/hosts** file **on ALL workstations**
- Add host to clinical and rlogin database (**risetup**)
- **Ping** the scanner from the workstation which will receive the images
- Add hostname of scanner to **/etc/hosts.equiv** on receiving workstations.
- Remove any “load_dicom” from root’s crontab (no longer used)
- Configure **/etc/inittab** (1 scanner per port) (make sure that r4 is unique)
 - r4:34:respawn:sh -c “exec /opt/ISTri/bin/ridicomd -f -p 104 -t RI_DICOM /img/incoming > /dev/null”
- Type “**init Q**” to have init reread the /etc/inittab file
- Use “**ps -ef | grep rid**” to make sure that the ridicomd is running
- Use debug mode if problems occur (add -v option after ridicomd in inittab)

FACILITY: _____ DATE: _____ INSTALLED BY: _____

S. NUCLEAR MEDICINE SCANNERS (INTERFILE FORMAT)

- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of scanner: _____
- ✓ Hostname of scanner: _____
- ✓ Does the scanner support interfile format: _____
- ✓ Can the scanner export interfile images into a predefined directory: _____
- ❑ Add hostname and IP address to /etc/inet/hosts file **on ALL workstations**
- ❑ Add host to clinical and rilogin database (risetup)
- ❑ Ping the scanner from the workstation which will receive the images
- ❑ Create a directory under “/img” to receive the images. This directory should be unique to the individual scanner (ie: each scanner **MUST** have a separate directory).
- ❑ `chmod a+rwX /img/prism` (allow all users to access directory)
- ❑ Configure the scanner to deposit interfile images into this directory (eg: For a Picker Prism scanner – call the directory /img/prism).
- ❑ Configure the “/opt/ISTri/bin/move_files_script” script to move (and rename) the images into the /img/incoming directory. The move_files program needs the input dir, the output dir, and the image prefix (eg: `move_files /img/prism /img/incoming Rlint.prism.`). The period at the end of “Rlint.prism.” is important. The name between the periods must be the name of the scanner “prism in this case”.
- ❑ Add the “move_files_script” routine to the crontab for “imaging”. Use “crontab -e” as imaging to add the new process and set it for 5 minute intervals as follows:
`“0,5,10,15,20,25,30,35,40,45,50,55 * * * * /opt/ISTri/bin/move_files_script > /dev/null 2>&1”`.
- ❑ Make sure that “riupdate” is running as a process and is configured to check the /img/incoming directory “/opt/ISTri/bin/load_riconnect”.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

T. LUNAR MR SCANNERS

- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of scanner: _____
- ✓ Hostname of scanner: _____
- ✓ Is the scanner dicom 3.0 compliant: _____
- ✓ RIlunar license required (license file/email): _____
- ☐ Add hostname and IP address to /etc/inet/hosts file **on ALL workstations**
- ☐ Add host to clinical and rilogin database (risetup)
- ☐ Ping the scanner from the workstation which will receive the images
- ☐ If DICOM 3.0 connection, use DICOM scanner setup.
- ☐ If not dicom 3.0, install ISTlunar package to retrieve images from the scanner
- ☐ Configure the /opt/ISTri/bin/.rilunar1 file for source and destination information.
- ☐ Run RIlunar to test the transfer. Make sure images transferred to /img/incoming.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

U. GATEWAY WORKSTATION (LOW BANDWIDTH)

- ✓ Cabling completed: _____
- ✓ Tranceiver needed: _____
- ✓ Scanner engineer notified: _____
- ✓ Ethernet card installed/configured: _____
- ✓ Ip address of gateway workstation: _____
- ✓ Hostname of gateway workstation: _____
- ✓ Ip address of scanner(s): _____
- ✓ Hostname of scanner(s): _____
- ✓ RImovedcm license required (license file/email): _____
- ✓ RIdicomd license required (license file/email): _____
- ✓ RIprint license required if return printing enabled (license file/email): _____
- ☐ Install Solaris 7
- ☐ Install Printer using admintool and test using lp "HP 2100m Postscript". This will only be present if remote printing is desired.
- ☐ Add packages ISTremote and ISTri
- ☐ cd /opt/ISTri/install and run "install_remote"
- ☐ mkdir /home/imaging/.solregis; touch /home/imaging/.solregis/disable
- ☐ Configure /opt/ISTri/etc/rimovedcm_cfg
- ☐ Add ridicomd to /etc/inittab
 - r1:34:respawn:/opt/ISTri/bin/ridicomd -f -p 104 -t RI_DICOM /img/incoming > /dev/null
- ☐ Add rimovedcm to /etc/inittab
 - r2:34:respawn:su - imaging "exec rimovedcm -c /opt/ISTri/etc/rimovedcm_cfg > /dev/null
- ☐ Add hostname and IP address to /etc/inet/hosts file **on ALL workstations**
- ☐ Add gateway host to clinical and rilogin database (risetup)
- ☐ Ping the scanner from the workstation which will receive the images
- ☐ Add the destination DICOM host to the /etc/hosts file. Ping to make sure it lives.
- ☐ Send images from the Lunar scanner to make sure that ridicomd is putting them in /img/incoming.
- ☐ Make sure that risenddcm is then moving these images over the low-bandwidth network to the remote destination.
- ☐ Set up printer per the "Low Bandwidth Printer" worksheet.

Functionality:

1. Receive images from scanners over 100baseT, and retransmit in the background over PPP, ISDN, or low-bandwidth Frame Relay.
2. Allow JPeg compressed printing to a low-cost HP 2100m Postscript Printer. The doctors can print to this from RView. The PrintPage will be compressed, sent to this gateway, decompressed, and printed. The PrintPages are on the order of 80KBytes for 80dpi printing. This fits the monitor size and printer output well. For higher quality, use 160dpi and reduce the image by 50% in imagetool before printing the image. RView will still print the 160dpi image correctly.
3. The printpage will also be stored on this system for future printing under /img/PrintPages. The Solaris "file manager" and "imagetool" can be used to select and print the images.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

V. TAPE DRIVE (STANDALONE PRIMARY ARCHIVE)

- ✓ Tape drive host: _____
- ✓ Tape drive alias: _____
- ✓ ApUnix DAT License #: _____
- ✓ Individual/research tape sets required: _____
- ✓ Power available for tape drive: _____
- ✓ SCSI cables OK (conversion required?): _____
- ✓ SCSI ID of Drive: _____
- ☐ Shutdown system and install second SCSI card (especially if on server)
- ☐ Configure Tape Drives SCSI ID's.
- ☐ Once installed, run "probe-scsi-all" at boot prompt to check ID's.
- ☐ Reboot using -r to recognize new hardware attached.
- ☐ Install ISTarc tape drive package
- ☐ Run install_arc to create drivers and licenses
- ☐ Reboot to load the new drivers
- ☐ Test the tape drive with a blank tape (write then read using tar)
- ☐ List tape sets and add new ones if necessary (primary, secondary, research)
- ☐ Add new tape drive in risetup (9)
- ☐ Make sure that the "/opt/ISTri/bin/backup_radiology" script works correctly.
- ☐ Make sure tape drive alias appears in Ristore menu.
- ☐ Test tape drive initialization on a blank tape.
- ☐ If having trouble with the SCSI bus on an Ultra 5 or 10, disable the Ultrawide scsi adapter by putting "scsi-options=0x78;" in /kernal/drv/isp.conf.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

W. JUKEBOX (SECONDARY ARCHIVE)

- ✓ Jukebox alias: _____
- ✓ Jukebox hostname: _____
- ✓ ApUnix DAT License #: _____
- ✓ ApUnix Changer License #: _____
- ✓ Individual/research tape sets required: _____
- ✓ Power sufficient for jukebox: _____
- ✓ SCSI cables OK (conversion required?): _____
- ✓ SCSI ID of Drive 1: _____
- ✓ SCSI ID of Drive 2: _____
- ✓ SCSI ID of Drive 3: _____
- ✓ SCSI ID of Drive 4: _____
- ✓ SCSI ID of Changer (Jukebox): _____
- ☐ Confirm that the system has Solaris 2.6 loaded. The changer will not work with 2.7.
- ☐ Shutdown system and install second SCSI card (especially if on server) Use the Antares Low Voltage Differential card for AIT Jukeboxes.
- ☐ Install the Antares drivers for Solaris 2.6 using pkgadd (AIT jukebox only).
- ☐ For AIT jukeboxes, make sure that the terminator is a "LVD" terminator.
- ☐ Configure Jukebox SCSI ID #'s and tape drives.
- ☐ Configure Tape Drives SCSI ID's.
- ☐ Once installed, run "probe-scsi-all" at boot prompt to check ID's.
- ☐ Reboot using -r to recognize new hardware attached.
- ☐ Install ISTjuke tape drive package
- ☐ Run install_juke to create drivers and licenses
- ☐ Reboot again to load the new drivers
- ☐ Test ability of jukebox to load tapes and drives (change command)
- ☐ Test each tape drive with a blank tape (write then read using tar)
- ☐ List tape sets and add new ones if necessary (primary, secondary, research)
- ☐ Add new tape drive(s) in risetup (one for each drive in jukebox) (9)
- ☐ Add new jukebox in risetup (37)
- ☐ Add new jukebox tape drive associations in risetup (one for each drive) (38)
- ☐ Add new jukebox slots in risetup (39)
- ☐ Add new tapesets supported on the jukebox in risetup (51)
- ☐ Make sure that the "/opt/ISTri/bin/backup_radiology" script works correctly.
- ☐ Test archive.
- ☐ Add Ribox, Ristore to Rilogin toolbar.
- ☐ If having trouble with the SCSI bus on an Ultra 5 or 10, disable the Ultrawide scsi adapter by putting "scsi-options=0x78;" in /kernal/drv/isp.conf.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

X. VIDAR FILM DIGITIZER

- ✓ Hostname of workstation attached to: _____
- ✓ Power available for it: _____
- ✓ SCSI cable correct (Large SCSI I connector on Vidar): _____
- ✓ SCSI ID of Vidar digitizer: _____
- ☐ Install vidar with power and scsi cable. Use ACTIVE terminator.
- ☐ Make sure that film guides are wide open during power-up (or else calibration wrong)
- ☐ Set the SCSI ID of the Vidar system.
- ☐ At boot prompt, use “probe-scsi-all” to check the SCSI ID.
- ☐ Boot with -r to recognize new hardware
- ☐ Install the ISTvidar package.
- ☐ Run the script /opt/ISTri/install/install_vidar
- ☐ Reboot to make sure that the drivers are loaded correctly.
- ☐ Add RIsan to the rilogin tool bar (config is under the disk icon).
- ☐ Restart rilogin from the workspace menu after quitting the current version
- ☐ Use RIsan to make sure that the scanner is working properly

FACILITY: _____ DATE: _____ INSTALLED BY: _____

Y. CANON CFS300 FILM DIGITIZER

- ✓ Hostname of scanner: _____
- ✓ IP address of scanner: _____
- ✓ Hostname of Riscanc SUN: _____
- ✓ IP address of Riscanc SUN: _____
- ✓ Rational Imaging license file (Riscanc): _____
- ✓ Facility cabled and power available: _____
- ✓ ftp client on SUN: (cfsscan) _____
- ✓ ftp passwd: (cfsscan!) _____
- ✓ Hostname of workstation to receive images:
 - Install the CFS300 scanner on the network and configure its IP parameters.
 - Add scanner hostname to /etc/inet/hosts **on ALL workstations**
 - Ping scanner from SUN workstation
 - Telnet to the cfs300 to configure the rest of the parameters (see Canon Digitizer section of this manual for details on these parameters). User=cfs300 Password=canon300. Type "diag" at the prompt.
 - Install ISTscanc package on the Sun workstation
 - Make sure that cfsscan user has been added to /etc/passwd and /etc/shadow.
 - Create passwd for cfsscan (passwd cfsscan).
 - If images forwarded to another workstation, complete the following 4 steps
 - 1) Configure /opt/ISTri/bin/ritransmit to send images to remote workstation
 - 2) Put /opt/ISTri/bin/ritransmit in "transmit script" of config popup
 - 3) Copy /opt/ISTri/bin/riceive to remote receive workstation
 - 4) Edit and configure /opt/ISTri/bin/riceive on the REMOTE receive workstation.
 - Try sending some images from the scanner (should arrive in /img/scan)
 - Run Riscanc and see if images displayed. Try saving images (save to /img/incoming)

FACILITY: _____ DATE: _____ INSTALLED BY: _____

Z. MODEM ON WORKSTATION

- ✓ Hostname of workstation attached to: _____
- ✓ Computer Grade Line (NOT centrix) phone number: _____
- ✓ For support only, teleradiology or both: _____
- ✓ Modem type (US Robotics recommended): _____
- ☐ Configure modem switches and internal registers
- ☐ Install modem to serial port on workstation
- ☐ Install ISTmodem package
- ☐ Execute the script /opt/ISTri/install/install_modem
- ☐ Set the line speed of the modem using tip ("tip -38400 /dev/cua/a", quit with ~.)
- ☐ Setup modem parameters using tip (see modem setup for setup string). Or use new application "/opt/ISTri/bin/risetmodem".
- ☐ If for teleradiography, add user telerad on ALL workstations with same UID.
- ☐ Set password on "telerad" account.
- ☐ Try telnetting to "telerad" on this workstation (should be able to login)
- ☐ Try connecting from a remote workstation to this computer (imaging or telerad)
- ☐ Download some images to make sure that the modem flow control is functioning.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

AA. BLAST REQUIRED TO SEND IMAGES TO PC's/MAC's.

- ✓ Hostname of workstation to use to send images: _____
- ✓ Blast license #: _____
- ✓ Modem currently installed and functioning: _____
- ☐ Run script "install_blast"
- ☐ Configure each user's ".cshrc" file in their home directory (add BLAST vars)
- ☐ Use risetup to add a modem
- ☐ Configure Rlcall to add the phone numbers of the remote modems.
- ☐ Make sure riqueued running on host (modem queue application) (load_riconnect)
- ☐ Install Hyperterm on the remote PC and configure it for Zmodem and receive dir.
- ☐ Load hypterterm and type "AT" to get it connected to the MODEM.
- ☐ Try sending some images from Rlcall on the Sun to Hyperterm on the PC.

FACILITY: _____ DATE: _____ INSTALLED BY: _____

BB. RIS CONNECTIVITY

- ✓ Hostname: _____
- ✓ Port Number (for HL7 messages from RIS): _____
- Create temporary HL7 message directory on the server
 - `mkdir /img/hl7msg`
 - `chmod 777 /img/hl7msg`
- Put rilink in /etc/inittab.
 - `r7:34:respawn:su – imaging –c “exec rilink –d /img/hl7msg –i 5000 –n”`
- Copy the RIS config file to /opt/ISTri/etc/rideliverd_cfg (see the available config files in /opt/ISTri/etc/examples)
- Modify /opt/ISTri/etc/rideliverd_cfg to suite the facility’s needs.
- Put rideliverd in /etc/inittab.
 - `r8:34:respawn:su – imaging –c “exec rideliverd –c /opt/ISTri/etc/rideliverd_cfg”`
- Start the processes by reinitializing init “init Q”.
- Verify that rilink is running “ps –ef | grep rilink”.
- Verify that rideliverd is running “ps –ef | grep rideliverd”.
- Try sending messages from the RIS system.
- Test and see that RIdeliver can list reports that did not match an accession number and medical record number (MRN).

FACILITY: _____ DATE: _____ INSTALLED BY: _____

CC. USER SETUP

- ✓ Username: _____
- ✓ Password: _____
- ✓ Unique User ID #: _____
- ✓ Group: (imaging) _____
- ✓ Home directory (/export/home/username): _____
- ✓ Defaults directory: _____
- ✓ Templates directory: _____
- ☐ Modify /etc/auto_home to add new user home directory
- ☐ Copy system defaults to user's defaults directory
- ☐ Copy system templates to user's templates directory
- ☐ Check permissions on defaults and templates
- ☐ Add user to UNIX (admintool) **on ALL workstations**. You can use the following shell command to add users also. This is convenient if you have multiple users and many workstations. Create a shell script with a line for each user. Then simply execute the shell script on each system as root. (Note: Each user **MUST** have a unique uid, so change 102 to a number NOT in the /etc/passwd file)

useradd -c "Imaging" -d "/home/imaging" -g imaging -u 102 -s /bin/csh imaging
- ☐ If admintool or the shell script did not make the user's home directory, create it now and change the owner to "user" and group to "imaging".
- ☐ Copy default home files (.login, .cshrc, .select_db) to new user's directory from /home/imaging. Make sure they maintain the user's owner and group permissions.
- ☐ Make sure that .select_db and .cshrc show correct database and redundant server
- ☐ Check ownership and permission on user's home directory (and contents)
- ☐ Log into main server and add user to patient and rlogin database (risetup)

FACILITY: _____ DATE: _____ INSTALLED BY: _____

DD. MOVE DATABASE TO NEW SERVER

- ✓ Old Server Name: _____
- ✓ New Server Name: _____
- ✓ Workstations to update (All RI workstations): _____
- ✓ : _____
- ✓ Users to update .cshrc: (imaging) _____
- ✓ : _____
- ✓ Reason for change: _____

ON THE OLD SERVER

- ❑ Notify the facility to stop using the system (especially archiving)
- ❑ Stop all RI and SQL processes on the server (slay ri; slay sql)
- ❑ Backup the database: `tar cpf /img/db.tar /db/*dbs`
- ❑ Rename the database: `cd /db ; mv radiology.dbs radiology.old`
- ❑ Disable the cronjobs other than “fix_ERR_incoming” by putting a “#” in front of each line. As imaging, execute the following: “setenv EDITOR vi; crontab -e imaging”
- ❑ Copy “/etc/rc3.d/S16ri.install” to the new server.
- ❑ Comment out the line in “/etc/init.d/ri.install” that says “/opt/informix/lib/sqlxecd &” by putting a “#” in front of the line. This will disable sqlxecd.

ON THE NEW SERVER

- ❑ Link the S16ri.install to ri.install as follows:
`ln /etc/rc3.d/S16ri.install /etc/init.d/ri.install`
- ❑ `mv /opt/informix to /opt/informixold`
- ❑ `mkdir /opt/informix`
- ❑ Set permissions: `chown informix /opt/informix; chgrp imaging /opt/informix`
- ❑ Copy the SE, SQL, and INET informix files from the CD to the new /opt/informix. Use the correct version of informix (“dbaccess -v” will give current version)
- ❑ License SQL: `cd /opt/informix; ./installsql`
- ❑ License SE: `./installse`
- ❑ License INET: `./installnet`
- ❑ Copy the database to the new server: Login to the new server and run “tar xpf /net/oldserver/img/db.tar”
- ❑ If a new informix version has been installed, you will need to perform a dbexport and dbimport to reconcile the database with the new functionality. Then apply “update statistics” in dbaccess.
- ❑ Modify “/opt/ISTri/bin/ridundant” to point to the new redundant host.
- ❑ Modify “/opt/ISTri/bin/backup_radiology” to point to the new redundant host.
- ❑ Add the ridundant, expire_locks and other SERVER cronjobs that were in the prior server to the new server. “setenv EDITOR vi; crontab -e imaging”. These should run as “imaging”, not “root”.
- ❑ Use risetup to edit the new database location “//newserver/db”. This is option 20.
- ❑ Rename the database: “`cd /db; mv radiology.old radiology.dbs`”
- ❑ Reboot the new server

ON ALL WORKSTATIONS

- ❑ Modify the RILOGDB environment variable in each user’s “.cshrc” file. Point this variable at the new database server.

- ❑ Copy redundant and backup_radiology from /opt/ISTri/bin on the new server to ALL hosts. “rcp /opt/ISTri/bin/redundant rihost:/opt/ISTri/bin”
- ❑ Reboot each workstation (including the old server as it is now just a workstation).

FACILITY: _____ DATE: _____ INSTALLED BY: _____

EE. CHANGE HOSTNAME OF RATIONAL IMAGING WORKSTATION

- ✓ Old Hostname: _____
- ✓ New Hostname: _____
- ✓ Workstations to update (All RI hosts): _____
- ✓ : _____
- ✓ Reason for change: _____
- Change the hostname in
 - /etc/hosts (on ALL workstations)
 - /etc/hostname.hme0 or /etc/hostname.le0 (100 to 10baseT)
 - /etc/auto_home
- Execute "**hostname newhostname**" as root
- Update licenses by logging into the database server and using dbaccess on the rilogin database to run the following query: **update sysistauth set hostname="newhostname" where hostname="oldhostname"**.
- Update the clinical database hosts table by using dbaccess on the radiology database to run the following query: **update host set hostname="newhostname" where hostname="oldhostname"**
- Modify the NFS directory name in the imagedir table using risetup and option 22.
- Reboot the host which has the new name.
- Update NISplus if necessary
- If the workstation was the server, then modify all config files associated with the server including:

/export/home/imaging/.cshrc	All hosts
/opt/informix/etc/sqlhosts	All hosts
/opt/ISTri/admin/risetup	Server
/opt/ISTri/etc/rid_balance	All hosts
/opt/ISTri/etc/rid_archive.dat	All hosts
/opt/ISTri/etc/rid_checkdb	All hosts
/opt/ISTri/etc/rid_move2bb	All hosts
/opt/ISTri/etc/rid_schedrm	All hosts
/opt/ISTri/etc/rid_thresharc	All hosts
/opt/ISTri/etc/rid_threshrm	All hosts
/img/ridistribute_balance	Server
/img/ridistribute_defaults	Server
/img/ridistribute_move2bb	Server
/opt/ISTri/bin/ridundant	Server
/opt/ISTri/bin/auto_archive.dat	Archive system
/opt/ISTri/bin/reset_modems	All hosts
/opt/ISTri/bin/auto_remove	All hosts
/opt/ISTri/etc/riprintq_cfg	DICOM print host (riprintq)

FACILITY: _____ DATE: _____ INSTALLED BY: _____

FF. RATIONAL IMAGING UPGRADE (VERSION 4.1 OR LATER)

- ✓ Main Server hostname (printenv RILOGDB): _____
- ✓ Current RI Version (cat /opt/ISTri/bin/riVERSION): _____
- ✓ New Version(s) to be added: _____
- ☐ Login as **imaging** on the **server**.
- ☐ Change user to root "**su**"
- ☐ Check the database space "**df -k**". It should have at least **20MB** of "avail" space.
- ☐ Make sure "/img" is a shared directory. Use the command "**share**" to verify.
- ☐ Untar the **latest** upgrade (ver_#.#.#) into /img/upgrade (or other NFS shared dir)


```
mkdir /img/upgrade
cd /img/upgrade
cp /cdrom/ist###/upgrades/sparc/ver_#.#.#.tar.Z /img/upgrade
uncompress ver_#.#.#.tar.Z
tar xpf ver_#.#.#.tar
rm ver_#.#.#.tar
cd ver_#.#.#
```
- ☐ Confirm /opt/ISTri/bin/riset on the **INTEL** systems is owned by **root**
- ☐ Confirm /opt/ISTri/bin/riset on the **INTEL** systems is mode **6711**
- ☐ Run "**./riupgrade**"
- ☐ Review the /img/intall.log file for errors.
- ☐ Review the intel_host:/img/install.log for errors.
- ☐ See any additional notes in the **README** file for the upgrades.

<i>Hostname</i>	<i>Errors observed</i>
☐ _____	_____
☐ _____	_____
☐ _____	_____
☐ _____	_____
☐ _____	_____
☐ _____	_____
☐ _____	_____
☐ _____	_____

USE THE FOLLOWING SPACE FOR UPGRADE NOTES:

FACILITY: _____ DATE: _____ INSTALLED BY: _____

GG. RATIONAL IMAGING UPGRADE (PRIOR TO VERSION 4.1)

- ✓ Server hostname: _____
- ✓ Current RI Version (cat /opt/ISTri/bin/riVERSION): _____
- ✓ New Version(s): _____
- ❑ Login as root on the server
- ❑ Backup the /opt/ISTri and /db directories
 - cd /opt
 - tar cpf /img/ist.tar ISTri
 - cd /db
 - tar cpf /img/db.tar *.dbs
- ❑ Backup the user templates and defaults (found in risetup #11).
 - echo "select deflt_dir,tmplt_dir from users group by deflt_dir,tmplt_dir" | dbaccess rilogin
 - tar cpf /img/defaults.tar /net/host/img/defaults /net/host/img/templates
- ❑ Stop all activity on the network (Tell users not to send images or use the workstations).
Make sure that sqlxecd and riupdate are stopped. Stop all archiving.
 - /opt/ISTri/bin/slay sqlxecd
 - Put a '#' after the ':' and before the "su – imaging ...riupdate" in /etc/inittab
 - init Q
 - /opt/ISTri/bin/slay riupdate
- ❑ Copy the upgrade directories to the /img partition on the server
- ❑ Apply the upgrade patches to the server IN ORDER (ie: Every patch from the current version to the new version MUST BE APPLIED to every workstation).
 - cd /img/ver_3.3.3/patch
 - ./riupgrade
- ❑ Apply the upgrade patches to EVERY workstation in the network. Be careful to apply sparc upgrades to the sparc systems, and intel upgrades to the intel systems. Document which hosts have been upgraded below. Document any errors observed.
 - telnet ri_host
 - su
 - cd /net/db_server/img/ver_3.3.3/patch
 - ./riupgrade
- ❑ See any additional notes in the README file for the upgrades (ver_3.3.3/README).
- ❑ Remove the '#' from the /etc/inittab file stopping riupdate, then type "init Q".
- ❑ Reboot the server.
- ❑ Reboot each workstation and then test the system and notify the staff.

<i>Hostname</i>	<i>Errors observed</i>
❑ _____	_____
❑ _____	_____
❑ _____	_____
❑ _____	_____
❑ _____	_____
❑ _____	_____
❑ _____	_____
❑ _____	_____

FACILITY: _____ DATE: _____ INSTALLED BY: _____

HH. UPGRADE INFORMIX SOFTWARE

- ✓ Hostname (recommend lowercase): _____
- ✓ Server or Redundant Server (Y/N): _____
- ✓ Informix SE license: _____
- ✓ Informix SQL license: _____
- ✓ Informix INET license: _____
- ❑ Stop the Imaging Network and kill the SQL processes.
- ❑ Install ISTdb723 using pkgadd (Informix database)
- ❑ Execute /opt/ISTri/install/install_informix script
- ❑ Modify the /opt/informix/etc/sqlhosts file. This has a new format and is required on each workstation.
 - pacs1 setlitcp pacs1 sqlexec**
- ❑ Add the following line to each user's .cshrc file (use correct servername)
 - setenv INFORMIXSERVER pacs1**
- ❑ Convert any databases to the new format using dbexport/dbimport. This step must be done on ALL databases (rlogin and radiology ...)
- ❑ Upgrade the system to version 4.2.0 (Informix 7.24 compliant). Make sure to use the packages for 7.24.
- ❑ Modify the "/etc/init.d/ri.install" file **on the server** to start sqlexecd with the name of the server.
 - /opt/Informix/lib/sqlexecd pacs1 &**
- ❑ Reboot the server (or start the sqlexecd process manually).

XXX.Index

- AIT, 34
- backup system, 93
- Blast
 - installation, 76
 - PC Setup, 77
 - Testing, 77
- boot procedure, 99
- calibration
 - monitor, 45
 - printer, 47
 - SMPTE pattern, 46
- Canon digitizer
 - configuration, 48
 - installation, 48
- database
 - backup, 101
 - centralized, 84
 - Change host, 95
 - client-server, 84
 - configuration, 89
 - copy exams between databases, 25
 - create patient database, 22
 - distributed, 84
 - duplicate keys, 102
 - errors, 101
 - export, 103
 - import, 103, 104
 - missing data pointers, 103
 - multiple servers, 23
 - patient, 10
 - rebuild, 108
 - RIbuild, 109
 - server, 12
 - software, 3
 - Version, 107
- diagnostics, 87
- dicom
 - scanners, 135
- DICOM
 - Aspect Interpreter, 56
 - Print Class, 56
 - Query/Retrieve, 67
 - RIprintq installation, 71
- disk
 - installation, 54
 - partitions, 14, 108
- Dome Monitor
 - calibration, 46
 - drag-and-drop, 5
 - EFilm – DICOM Test Client, 69
 - Expired exam locks, 92, 93
 - Gateway workstation, 138
 - hosts, 8
 - Hyperterm, 77
 - INFORMIX UPGRADE, 152
 - inittab, 16
 - installation, 18
 - Installation Worksheet, 112
 - interfile scanners, 136
 - internet address, 13
 - Jaz drive, 18
 - Jukebox
 - AIT Drive, 34
 - installation, 33
 - locked system, 100
 - lunar mr scanners, 137
 - memory, 2, 98, 99
 - Monitor
 - calibration, 44, 45, 47
 - installation, 44
 - mount
 - Jaz disk, 18
 - network
 - reliability, 85
 - printer
 - calibration, 47
 - Rational Imaging, 4
 - version, 26, 87
 - redundant server, 109
 - Redundant Server, 98, 110
 - requirements
 - hardware, 2, 7
 - overview, 1
 - software, 3
 - Rideliverd, 58
 - Rilink, 58
 - RIprintq
 - Delete Print Pages from Queue, 74
 - installation, 71
 - Reset Queue, 74
 - RIS
 - Rilink/Rideliverd, 58
 - SCSI
 - ID, 54

- Low Voltage Differential, 35
- Single Ended, 35
- server
 - Change host, 95
- shutting off the system, 98, 99, 100
- SMPTE pattern, 46
- supported scanners, 4
- system crash, 85
- system halt, 100
- Tape Drives
 - AIT, 34
 - Archive, 10
 - Device Drivers, 4
- technical support, 1
- users, 11
- version, 26
- version, 87
- Vidar
 - installation, 39
- Video Cards
 - Raptor, 43
- worksheet, 6
- worksheets
 - Blast, 144
 - Canon Film Digitizer, 142
 - Canon printers, 127
 - CEMAX card, 130
 - Change Hostname, 149
 - DICOM
 - Printer, 132, 145
 - scanners, 135
 - Gateway workstation, 138
 - GE 4x Signa MR scanners, 134
 - GE scanners, 133
 - Greyscale Monitors, 125
 - INFORMIX UPGRADE, 152
 - Interfile Scanners, 136
 - Jukebox, 140
 - Low-Bandwidth printer, 129
 - Lunar MR scanners, 137
 - main server, 113
 - Modem, 143
 - Move Database Server, 147
 - multiple servers, 117
 - new image partition, 123
 - redundant server, 115
 - satellite workstation, 119
 - SeeMor printer, 128
 - staff workstation, 121
 - Sun monitor, 124
 - Tape Drives, 139
 - Upgrade procedure, 150, 151
 - User Setup, 146
 - Vidar film digitizer, 141
 - VirtualRad Printer, 131
- Workstation
 - main server, 12
 - satellite, 17
 - upgrade, 26